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TABLE OF CONTENTS.

ENGINEERING NEWS OF THE WEEK..333, 339, 347
New Masonry Lining for the Mullan Tunnel, No. Pac. Ry. (illustrated)..... 334
The Brooklyn Bridge, Cleveland, O. (illustrated, with inset)..... 334
Railway Signaling..... 335
The Drainage of the Zuider Zee (illustrated)..... 336
The Saginaw Bridge Failure (illustrated)..... 337
T-Rails for Street Railway Track in Paved Streets 338
Methods of Preventing Electrolysis of Iron Mains 338
Papers Read before the American Street Ry. Association..... 345
The Lancaster Reservoir Failure..... 346
The Air-Brake Patent Decision..... 346
New System for Fireproof Flooring (illustrated). 347

PERSONALS, NEW PUBLICATIONS, SOCIETY PROCEEDINGS.....339, 341

EDITORIAL NOTES..... 342
Some Objections to High Buildings—The Increasing Use of Steel Beams—The Possibilities of Foreign Trade for American Bridge Builders—The Hudson Bay Railway Scheme.

EDITORIAL:
The Air-Brake Patent Litigation and Its Lessons 342

LETTERS TO THE EDITOR..... 343
A New Method of Determining the Character of Stress—Formulas for Earthwork Computation—A Standard Bell for Cast Iron Pipe—Subject for Theses—American Portland Cement—Notes and Queries.

CONSTRUCTION NEWS..... 348
Railways, Street and Electric Railways, Elevated Railways, Highways, Bridges, Water-Works, Artesian Wells, Irrigation, Sewers, Streets, Electric Light and Power, Miscellaneous Contracts and Supplies. Condensed List of Contracts Pending with Date of Opening Bids, Contract Prices, Metal Market Prices.

INDUSTRIAL NOTES..... 352

STOCK AND BOND MARKETS..... 352

Tests of concrete and iron floor arches, on the Melan system (Eng. News, Aug. 24, and Nov. 16, 1893), are to be made in New York city, and five of these arches have been recently built. One arch is 7 ft. span and 6 ft. wide, with three 4-in. I-beams 3 ft. apart. Two others are similar, but of 6 ft. span, and the remaining two are 6 ft. span and 4 ft. wide, with 3 T-bars, 3×3 ins., 2 ft. apart. The iron arch beams rest between 12-in. I-beams, which latter are held together by angle irons, 3×2 ins., bolted to the top and bottom flanges at each end, while the bottom flanges are also connected by two flat bars, ¾×2 ins., with the ends bent around the flanges. Upon the wooden centering is laid the concrete arch, 4 ins. thick, composed of 1 part Manheim Portland cement, 2 parts sand and 4 parts ¾-in. stone, well rammed against the sides of the arched beams and backed up to the under side of the top flanges of the 12-in. beams. The construction was under the supervision of Mr. Fr. Von Emperger, who represents the Melan system in this country, and Mr. Geo. Hill, Assoc. M. Am. Soc. C. E. A large number of tests are to be made by Mr. Hill, including various systems of floor construction, with concrete, brick and fireproof tile arches. For making these tests he has had a special hydraulic press made by Watson & Stillman, of New York, which will be fitted with the Bristol recording pressure gage. The results of the Melan tests will be reported in these columns; but engineers desiring to witness them are invited to send their names to Mr. Emperger, who will then send them notice prior to the loading of the arches.

Tests of flat fireproof floors, made of concrete with wire and iron rods embedded therein, were made recently at Trenton, N. J., by the Metropolitan Fire Proofing Co., of Trenton, in the presence of a large number of specially invited visitors. The wire is stretched across between the top flanges of I-beams and is then covered by and bedded in a mixture of plaster of Paris, coarse sawdust and cement, forming a flat platform or pavement, with the ends carried down so as to cover the webs and lower flanges of the beams. A span of 4 ft. 6 ins. c. to c. of beams, 4 ft. 0½ in. clear between flanges, area 10.105 sq. ft., deflected 1-16 in. under 348 lbs. per sq. ft. and 11-16 in. at 894 lbs., failing at 1,551 lbs. by the breaking of some of the wires on one side. In a hollow segmental arch, 5 ft. 2⅝ ins. span, the lower joints commenced to open before a load of 300 lbs. per sq. ft. and failed suddenly under 411 lbs. from the breaking of the skewbacks. In impact tests on the Metropolitan floor construction, a 205-lb. cylindrical weight, 9¾ ins. diameter, was dropped from a height of 5 ft., striking with its edge on the composition, cutting into it and spreading, but not breaking, the wires until the weight was dropped five times in one place, when the weight broke or cut them and fell through the floor, making a rather clean-cut hole, but little larger than the weight. The span was 3 ft. 9 ins. In the fire test a hardwood fire was kept burning under an arch of 5 ft. 6 ins. span, for three hours, when it was extinguished by water from a hose, the water being thrown also on the floor, without causing the composition to crack, splinter or show signs of disintegration. The beams and the arch surface not exposed to the flames remained cool. After the fire had been extinguished a hole was cut in the floor and it was found that the surface exposed to the flame was affected for a depth of about ½-in., the remainder being uninjured, while the efficiency of the floor to carry weight was apparently undiminished.

A noiseless street-paving block has been tried in Munich, by the City Architect, Mr. Rettig, with considable success. The material is finely ground serpentine, compacted together with a patented but undescribed binding material, then molded into blocks and fired in porcelain kilns, at a high temperature, almost to a point of fusion. When tested, the tensile strength is said to be very high, the wear relatively small, much less than granite and equal to the best porphyry. The edges and corners exposed to blows are the strongest parts of the block, being hardest burned and also slightly rounded off. Notwithstanding their hardness, these blocks are said to possess a certain compressibility, as blows with a heavy hammer leave slight dents. This property gives them great freedom from noise caused by passing traffic. There is also a certain roughness or grain, due to the unequal wear of the calcined serpentine and the softer binding material, so that they are not slippery. Each block is 4×7×7 ins., and the present cost is $4.19 per sq. yd.; but the blocks can be turned to use all four faces, making them less expensive in Munich than granite.

The Northwestern Elevated Ry. Co., of Chicago, has filed the complete route of its proposed elevated passenger railway line with the city officials. It is its announced intention to begin construction next spring. According to the plans filed, the road will have its southern terminus on Wabash Ave., between Monroe and Madison Sts. It will then run west to a point between La Salle St. and Fifth Ave., then north across the Chicago River to Michigan St., west to a point between Franklin and Market Sts., and north to North Ave. At North Ave. a short turn west will be taken to Weed St. and then the route is northwest and north to Dakin St., approximately 4½ miles north of the southern terminus. At Dakin St. a turn is taken west to the tracks of the Evanston Division of the Chicago, Milwaukee & St. Paul Ry., which are followed to Wilson Ave., and this will be for the present the northern terminus of the river. The plans show a strip of land 100 ft. wide along the route outlined and somewhere within this 100 ft. the line will be constructed, its exact location depending, of course, upon the relative expense of right of way at different points. The franchise for this road was secured in January, 1894, and one year was allowed the company in which to file the plans showing the general route of its line. The franchise also required that the main line should be in operation within three years, and its branches within five years. The routes of the branches have not been decided upon definitely, but in a general way they will leave the main line; (1) between Monroe St. and the Chicago River, running west to Halsted St. and there branching out in two directions; (2) between Chicago and North Aves., running west to Ashland Ave. and thence north to the city limits; (3) a point north of Division St., running north or northeast to the city limits, and (4) between North and Belmont Aves., running west. It is understood that much of the most costly right of way has been secured for the main line, but, so far as is known, nothing has been done toward securing the right of way for the four branches. It may be noted in this connection that an injunction has already been secured against the company by one of the property-owners on the route, on the ground that the plans of the route submitted do not conform with the provisions of the ordinance.

The most serious railway accident of the week was the derailment of a coal train in the Communipaw yards of the Central R. R. of New Jersey, on Oct. 19, in which one man was killed and three cars were wrecked. The accident was caused by a misplaced switch.

A dam across Gould creek, at Cobden, Ont., gave way Oct. 18, and the new electric light plant power house, with its machinery, was destroyed by the flood. The dam was 250 ft. long and 35 ft. high.——The dam of the large reservoir of the Tecumseh Iron Works, Tecumseh, Ala., gave way Oct. 11, involving a loss of about $5,000.

A heavily-loaded cable railway train ran away in the Washington St. tunnel, Chicago, on Oct. 23, owing to the load being too much for the grip as the train was ascending the steep grade out of the tunnel. The train consisted of a grip car and three trail cars, and is said to have had about 250 passengers. A collision with the train behind was narrowly averted. Several persons were bruised and slightly injured in the panic.

Two electric cars on the Schenley Park & Highland Electric Ry., at Pittsburg, Pa., collided Oct. 23, and one man was seriously injured. A heavy fog prevailed at the time, but both cars are said to have been running at high speed.

A comparison of the energy and efficiency of compound and simple locomotives is to be made by the Grand Trunk Ry., which is building two locomotives of almost identical construction, except that one is a simple engine and the other a two-cylinder compound on the system owned by the Rhode Island Locomotive Works. They will have the same cylinder power and each will carry 180 lbs. boiler pressure.

The East Bluff stand-pipe at Peoria, Ill., which was condemned as unsafe by the experts for the Pittsburg Testing Laboratory in their recent report to City Engineer Jacob A. Harman (Eng. News, Oct. 4), is to be taken down and replaced by a new structure, according to an order passed by the Peoria City Councils, Oct. 2. The council also ordered the Water Co. to rebuild West Bluff stand-pipe, which failed March 30, 1894 (Eng. News, April 5, 12 and 26). As far as can be learned, no time limit was set by the council within which the work should be done.

The U. S. battleship "Maine" was officially tested for engine requirements on Oct. 17, on Long Island Sound. During four hours under forced draft the general average steam pressure was 141 lbs. at the boilers, the propellers making 127 revolutions per minute. Though the official figures are not yet worked out and reported, the estimate of experts is that the "Maine" will exceed her contract requirement of 9,000 I. HP. by about 400 HP. The run over the 25-mile course buoyed out for the speed trial of the torpedo boat "Ericsson" gave an average speed of 15.95 knots per hour; allowing 1¼ knots for tide, the result is 17.25 knots, as compared with a speed requirement of 17 knots. The "Maine" is 6,648 tons displacement, and was built at the Brooklyn Navy Yard; while the engines were built by N. F. Palmer & Co. (the Quintard Iron Works). During the trial the temperature at the cylinders under the protective deck in the engine room rose to 180°, and averaged 146°; in the fire room it ranged from 180° to 115°.

Experiments with the new navy .236-in. caliber rifle, with nickel-steel coated bullets and smokeless powder, have been recently made upon cadavers and horses, to ascertain the effect upon the bones and tissues of the human body. The results are arranged in two groups; those from 50 to 300 yds. and those from 300 to 2,000 yds. Injuries under the first group show that when a bone is struck the effect is of an explosive character; the part is always pounded and fragments are frequently carried out through the wound of exit, leaving a gaping orifice; the muscles are pulped and the limb, in fact, mangled beyond repair. With the ball simply passing through a muscle, there is practically no important damage, unless an artery is cut; and when an artery is cut it is as with a knife, causing hemorrhage. When bones are struck at ranges of from 300 to 1,000 yds. the bullets have a tendency to break up and pulverize resisting parts of the bone, and to make comparatively clean holes through the non-resisting parts, like the extremities of the bones. It was evident that a wound near a joint may be less dangerous than one some distance from it, a surgical paradox. In dealing with savages, who do not seem to suffer from shock, Lieut. Lincoln Karmony, U. S. Marine Corps, who makes this report, says that it is best to make a chief target of the lower extremities. With a civilized foe, a simple flesh wound is usually enough.

The Georgian Bay Ship Canal & Power Aqueduct Co. is having a serious time in its endeavors to obtain a franchise from the Toronto authorities. Mr. E. A. Macdonald, the chief promoter, apparently cannot satisfy these authorities as to the company's financial ability to carry out the work proposed, nor the advantage of his offers to the city. Mayor Kennedy said that the offer of 1 ct. per HP. per hour was no offer at all, as the Niagara Falls Power Co. had offered to supply power at one-fifth that rate, and steam power was to be had in Toronto for 3-5 ct. per HP. hour. The trouble seems to be that the company wants all the advantages with the city to take the risks.

NEW MASONRY LINING FOR THE MULLAN TUNNEL, NORTHERN PACIFIC RY.

A paper read before the Montana Society of Civil Engineers by Mr. H. C. Relf, and published in the journal of the Association of Engineering Societies for August, 1894, contains an interesting account of the work of lining the Mullan tunnel on the Northern Pacific Ry. with masonry, to replace the old timber lining. This tunnel is 3,850 ft. long and crosses the main range of the Rocky Mountains, about 20 miles west of Helena, Mont. The tunnel is on a tangent throughout and has a grade of 20‰ falling toward the east. The summit of the grade, west of the tunnel, is 5,548 ft. above sea level, and the mountain above the line of the tunnel rises to an elevation of 5,855 ft. Owing to the treacherous nature of the material through which the tunnel passes, it has been a constant menace to traffic ever since its construction in 1883, and numerous delays to trains have been caused by the falls of rock and fires in the timber lining. For these reasons it was finally decided to build a permanent masonry lining, and work on this was begun in July, 1892.

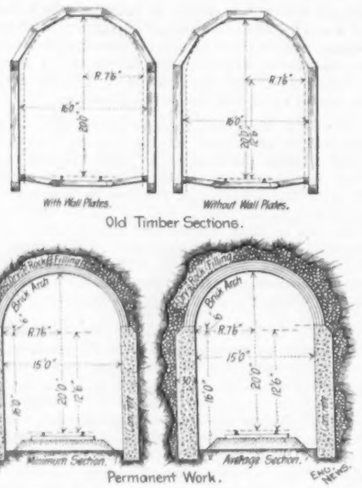
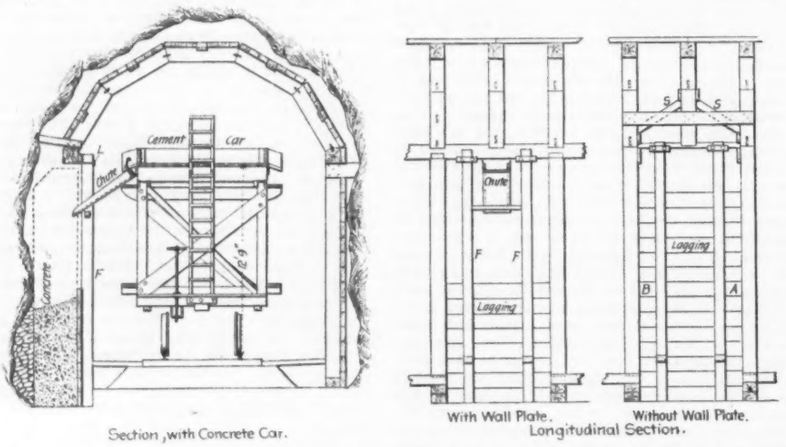


Fig. 1. Sections Showing Old Timber and New Masonry Linings for the Mullan Tunnel.

The original timbering consisted of sets spaced 4 ft. apart c. to c., with 12 × 12-in. posts supporting wall plates, and a five-segment arch of 12 × 12-in. timbers joined by ½-in. dowels. The arch was covered with 4-in. lagging, and the space between this and the roof was filled with cordwood. Except where the width had been reduced by timbering placed inside the original timbering to increase the strength, the clear width was 16 ft. and the clear height 20 ft. above the top of the rail. Fig. 1 shows the timbering and also the form of masonry lining adopted. The side walls are of concrete and the arch of brick. This new masonry, of course, required the removal of all the original timbering. The manner of doing this work was as follows: A 7-ft. section, A. B., Fig. 2, was first prepared by removing one post and supporting the arch by the struts, S S. After clearing away any backing and excavating for the foundation of the side wall, two temporary posts, F F, were set up and fastened by hook bolts, Fig. 2, L, and a lagging was built to form a mold for the concrete. Several of these 7-ft. sections were prepared at a time, each two being separated by a 5-ft. section of timbering.



F G. 2. TRANSVERSE AND LONGITUDINAL SECTIONS SHOWING MANNER OF BUILDING SIDE WALLS

The mortar car was then run along and enough mortar (1 cement to 3 sand) was run by the chute into each section to make an 8-in. layer of concrete. As the car passed along to each section, broken stone was shoveled into the last preceding section until all the mortar was taken up. The walls were thus built up in 8-in. layers, and became hard enough to support the arches in about 10 to 14 days. The arches were then allowed to rest on the wall and the posts of the remaining 5-ft. sections were removed and the concrete wall built up in the same way as before. English Portland cement was used, and about five parts of broken stone to four of mortar.

The average progress per working day was 30 ft. of side wall, or about 45 cu. yds., and the average cost, including all work required in removing the timber work, train service, lights and tools, engineering and superintendence, and interest on plant, was $8 per cubic yard.

The centering used for putting in the brick arches is shown in Fig. 3. From 3 ft. to 9 ft. of arch was put in at a time, the length depending upon the nature of the ground. To remove the old timber arch, one of the segments was partly sawed through and then a small charge of giant powder was exploded in it, the resulting debris, cordwood, rock, etc., being caught by a platform car extending the full length of the tunnel underneath. From this car the debris was removed to another car, which conveyed it out of the tunnel. The center was then placed and the brickwork begun, the cement car shown in Fig. 2 being used for mixing the mortar. The size of the bricks used was 2½ × 2½ × 9 ins., four rings making a 20-in. arch and giving 1.62 cu. yds. of masonry in the arch per lin. ft. of tunnel. The bricks were laid in rowlock bond, two gangs of three bricklayers and six helpers each, laying about 12 lin. ft. per day. The brickwork cost about $17 per cu. yd. The total cost of the new lining will average about $50 per lin. ft. The building of the arch had not been completed at the time the paper was read, Feb. 10, 1894.

In addition to the information contained in the above abstract we have obtained from Mr. Relf, the author of the paper, through Mr. F. J. Taylor, the Assistant Engineer now in direct charge of the work, some information as to the practice of building the wall by dumping the mortar and the broken stone separately, concerning which some queries have been raised. We quote as follows from Mr. Taylor's letter:

It has always been my idea that the proper way to build the walls so as to secure the most economical use of material would be to mix the mortar and rock in proper proportions before the concrete is deposited in walls. To do this under the circumstances which prevail here, so as not to lose too much time, would require a concrete mixer on the staging car. This would make necessary the installation of an electric plant, as I do not think any other than an electric motor would be adapted to the exigencies of the case. As for mixing the rock and mortar by hand, the extra labor necessary and loss of time would more than make up for the loss of mortar occasioned by the present method.

The material is not deposited in layers of different composition, as can be seen on the first sections after the timber has been taken out to build the second sections. In building the walls, particular attention is given to seeing that the mortar fills the voids in rock for the stipulated width of wall. The rock is generally deposited so as to slope from the face of the wall up towards the back, and after the next layer of mortar is deposited the rock is pulled down from the back and rammed into the mortar. No particular attention is given to ramming other than results from this pulling forward of the rock and seeing that the mortar is properly distributed, and that occasioned by throwing in the additional rock required to fill the mortar and slope it back as above-mentioned. The main objection to this method is that the mortar must be made rather thin, and that the proportion of mortar to rock is greater than it would be if the ingredients were all mixed before being deposited in the wall. This results in a loss of economy rather than strength, as it is evident that the wall would be quite as strong if it were made entirely of mortar.

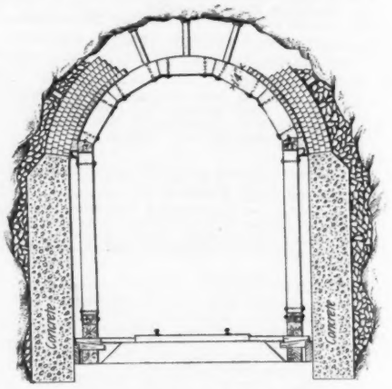


Fig. 3. Section Showing Timber Center for Arch Construction.

THE BROOKLYN BRIDGE, CLEVELAND, O.

(With Inset.)

We illustrate on our inset sheet this week and in the accompanying cuts the general structural details of the Brooklyn Bridge, recently completed on the line of Pearl St., at Cleveland, Ohio. This structure was built to replace an old highway bridge which had become inadequate to accommodate the increasing travel; and the conditions necessitated several somewhat novel and interesting details in the design. We are indebted to Mr. Frank C. Osborn, M. Am. Soc. C. E., the Chief Engineer of the work, for the drawings and other matter from which the description and illustrations have been prepared.

As will be seen from the general elevation, Fig. 1, the structure is 1,542 ft. long, c. to c. of end bearings, and consists of a series of trussed spans alternately 28 ft. and 56 ft. long, carried on steel trestle towers, with a steel arch span 168 ft. long over the creek and the tracks of the Cleveland Belt Line Ry. The roadway is 29½ ft. wide in the clear, and at each side there is a 6-ft. sidewalk. The entire structure is of steel, and was calculated for a moving load of 4,000 lbs. per lin. ft. The legs of the towers are supported on masonry foundations carried to shale rock in all cases except the north abutment, which rests on a firm blue clay. All of the superstructure is of steel.

Fig. 2 shows the general details of one of the 28-

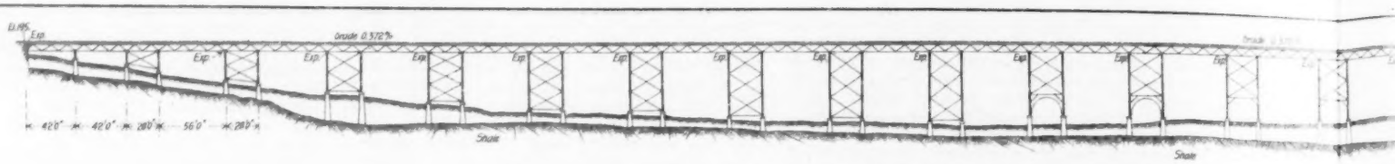


FIG. 1. GENERAL ELEVATION OF VIADUCT.

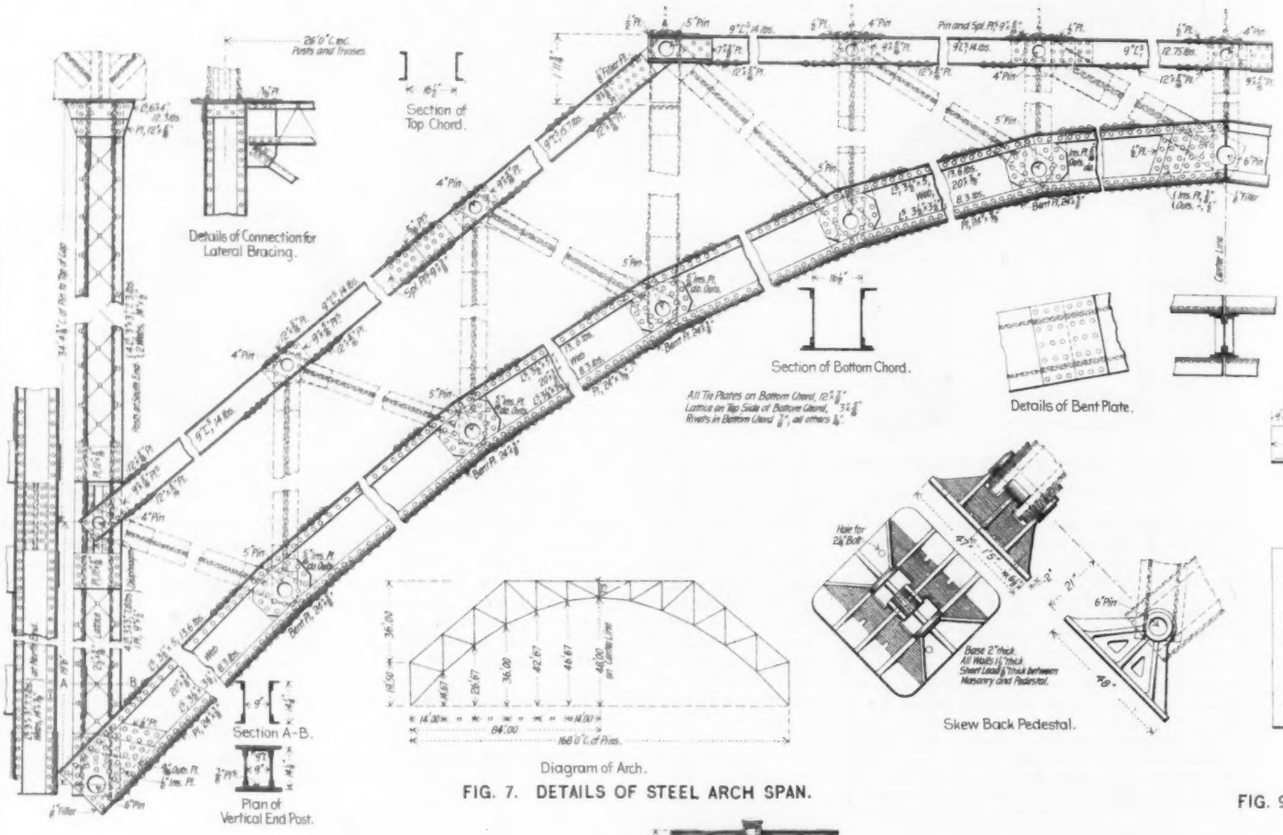


FIG. 7. DETAILS OF STEEL ARCH SPAN.

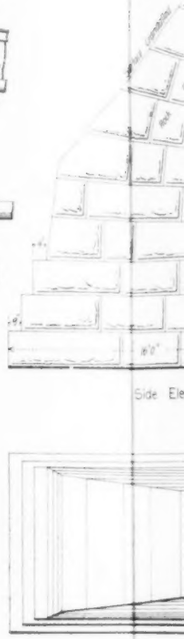


FIG. 9. ELEVATIONS AND P
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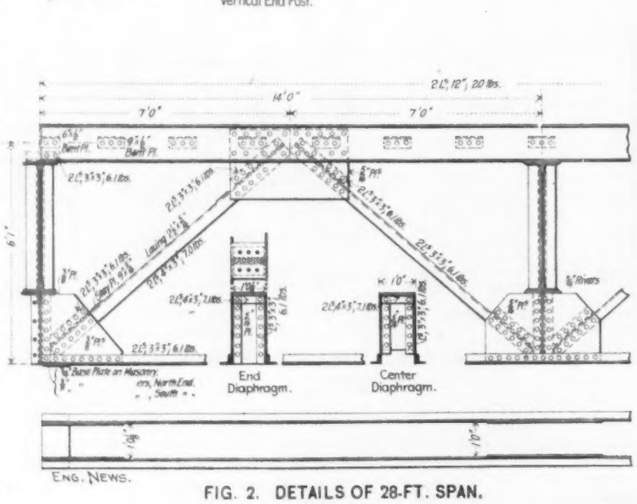
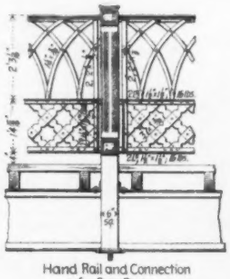


FIG. 2. DETAILS OF 28-FT. SPAN.



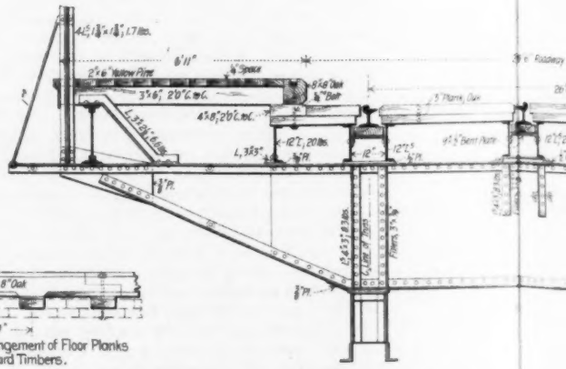


FIG. 3. DETAILS OF FLOOR BEAMS AND FLOOR

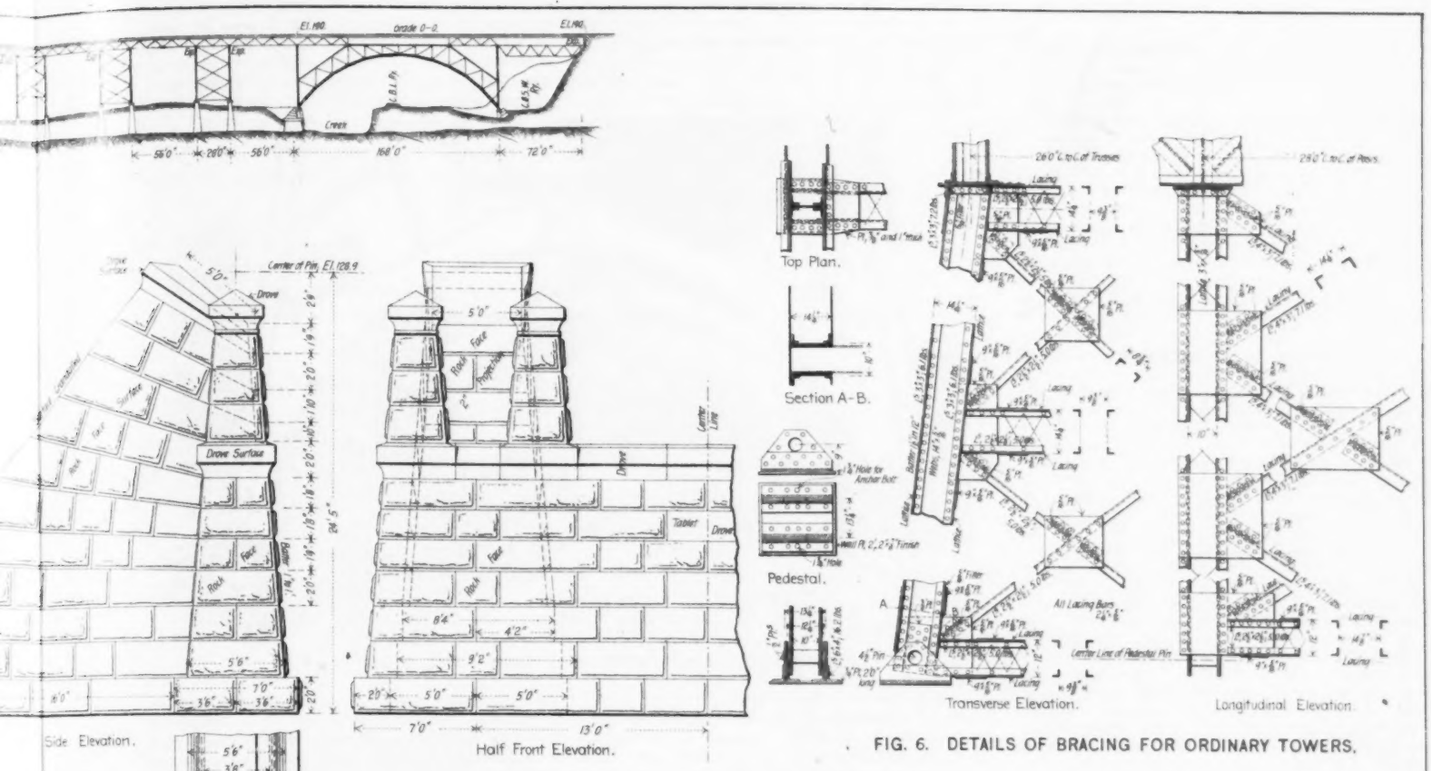
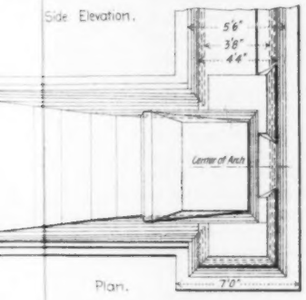
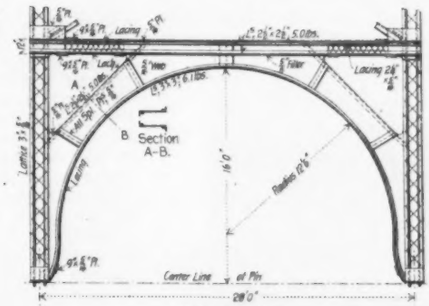


FIG. 6. DETAILS OF BRACING FOR ORDINARY TOWERS.



ATIONS AND PLAN FOR NORTH ABUTMENT FOR 168 FT. ARCH.



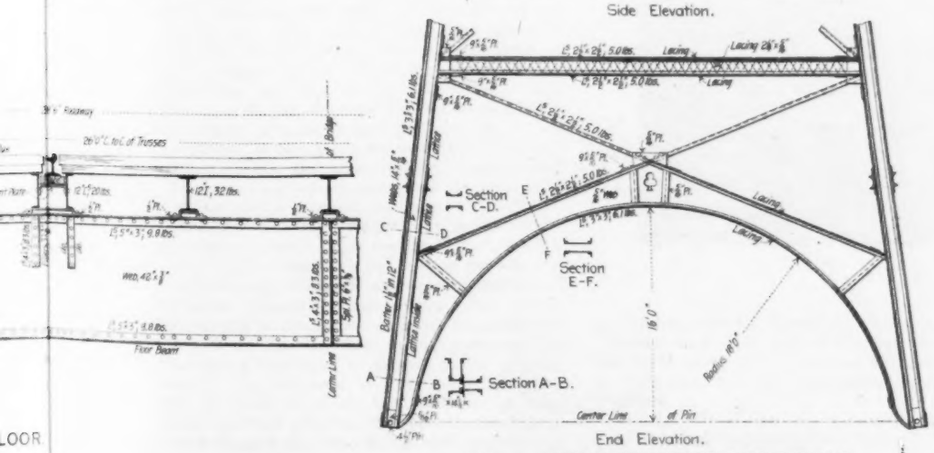


FIG. 5. DETAILS OF ARCHED CONNECTIONS FOR TOWERS 11 TO 14 INCLUSIVE.

LOOR

BROOKLYN-BRIGHTON-VIADUCT,

CLEVELAND, O.

Frank C. Osborn,
Frank C. Osborn, M. Am. Soc. C. E.,
Chief Engineer.

The King Bridge Co.,
Contractors for Superstructure.

E. S. & C. E. Doolittle,
Contractors for Substructure.

CHAS. HART & SONS, LITH., 95 VESEY ST., N. Y.

ft. truss spans. The design of the 56-ft. spans is similar in all respects. A peculiarity in the connection of the floor beams will be noticed in these spans. These beams rest upon a diaphragm placed between the gusset plates of the bottom chord connections; the tops of these diaphragms being planed to give a true bearing to the beam. The beam and the top chord are riveted together so that the chord is supported on the beam, thus dividing the top chord into 7-ft. panels. This construction is quite clearly

FIG. 4. VIEW OF ARCHED CONNECTION FOR TOWER LEGS.

shown by the drawing. Its object was to increase the rigidity of the bridge by introducing through the floor beams what constituted practically a solid web sway system. This detail is further illustrated in Fig. 3, which shows the general design of the floor system.

It will be noticed from these drawings of the floor that the outer floor stringers have been designed for carrying the rails of a street railway which it is expected will cross the bridge. These stringers are made up of two 12-in. channels, spaced 12 ins. apart back to back and tied together with ½-in. flanged plates. These plates form supports for timber blocks or a longitudinal timber track stringer, as may be desired, upon which the rail will be supported. With this arrangement it will be seen that when the tracks are added the planks of the flooring will rest directly on the flanges of the channels, while the street railway rail will be supported on the flanged plates, which allows of either the railway track or the bridge flooring being renewed without disturbing the other. It also allows of any depth of rail being used, by simply increasing or decreasing the thickness of the wooden block or stringer supporting it. Fig. 3 also shows the design of the hand rail for the side walks. Aside from these details, the truss spans need little mention, except, perhaps, to note that they are riveted throughout. In fact, this is the case with all the steel work except the arch span, which is pin-connected.

Turning to the towers supporting the 28 and 56-ft. spans, it will be noted that towers 11 to 14 inclusive have their legs connected by arches to provide for a roadway. This road is on the west side of the bridge at the north end, and on the east side of the bridge at the south end, crossing underneath the bridge through the open towers. The longitudinal arches in the towers are made to permit free access to the roadway from the adjacent property. This was a stipulation of some adjacent property owners. By reference to the perspective view (Fig. 4) it will be noted that the effect of these arches is rather pleasing, and that the freedom of passage underneath the bridge well justifies the comparatively slight extra expense of the arch construction. It will also be noted that these arches are made double, connecting to the outer flanges of the tower posts. The structure has now been in use for several months, and it is stated is proving very rigid and remarkably free from vibrations. The details of these arch constructions are shown in Fig. 5. Details of the framework of the other towers are shown in Fig. 6.

Fig. 7 shows the details of the 168-ft. arch, and Fig. 8 is a view of the same from a photograph. Fig. 9 shows elevations and a plan of the north abutment for the arch. This arch span was adopted partly for the purpose of getting the ironwork as far as possible above the railway line, and in deciding upon the length of span, consideration was given to the contemplated construction of another line of railway, which would also pass underneath it. The construction of the abutment is clearly shown by the drawing, and needs no further mention. In erecting the ironwork a traveler was used, and when the arched span was reached this was erected panel by panel, the falsework being set by the traveler as the work advanced. The total cost of the bridge, including the foundations and right of way, was about $170,000.

Messrs. E. S. & C. E. Doolittle were the contractors for the substructure, and the King Bridge Co., of Cleveland, were the contractors for the superstructure.

FIG. 8. VIEW OF 168-FT. SPAN.

RAILWAY SIGNALING.*

Your committee on railway signaling, not wishing to run counter to the joint committee on interlocking and block signals of the American Railway Association, which has in hand the work of enunciating the principles involved in railway signaling, with a view of formulating rules to govern the practice of operation, will confine its report to a presentment of the question of the utility of the different systems of block signaling, as it relates to their capacity and adaptability under different conditions of service, not with reference to the roads already to a greater or less extent equipped with block signals, but especially for the benefit of the larger number of roads which are not being operated under block signal practice.

Capacity.—Three distinct systems of block signaling are worked to a considerable extent on American railways, all of which have been sufficiently developed under conditions that admit of their capacity being reckoned with accuracy: (1) The telegraph block signal system, which is operated manually as directed by telegraph; (2) the controlled manual block signal system, which is operated manually, but prevents by mechanical device or otherwise the display of a clear signal while the block is occupied by a train; (3) the automatic block signal system, which is self-operative, whether by mechanical, electric, pneumatic or other device.

There is a marked difference in the capacity of these three systems, that is, in the number of trains that can be moved over a road under the protection of block signals in a given time. With the telegraph system, the signalmen are required to record the time of all passing trains, to report to the signalmen in the rear and in advance, and to manipulate a number of signal levers, all of which requires more or less time. In the operation of the controlled manual system practically the same procedure is required, but owing to the use of distant and advance signals, which are worked quickly by mechanical devices and which are not used to advantage in the telegraph system, more trains can be moved in a given time, especially during fog and storm, than under the telegraph system. With the automatic system, everything being self-operative, the factor of time required in operation is reduced to the minimum and the capacity of track is limited only by the maximum length of the trains, their speed and the efficiency of the train brakes. Therefore, so far as capacity is concerned, the telegraph system represents the first stage of block signaling, the controlled manual an improvement over the telegraph system, and the automatic the system of greatest possible capacity.

Adaptability.—In considering the adaptability of the different systems for use on American railways, the phase of the question as it relates to the present and prospective volume of traffic, the condition of the road-bed, and the number of stations and their location as to distance one from the other, must be kept in full view. But the time has come when no railway handling a considerable freight and passenger traffic and which moves high and low speed trains over the same track can afford to allow the question of expediency—whether it will pay or not—to any longer stand in the way of the adoption of one or the other system of block signaling. The failure of American railway companies to more generally avail themselves of this simple means of protection against train collisions is marked by the most frightful record of death, personal injury and destruction of property. In strong contrast stands the record of English railways, which are almost universally operated with

*Report presented at the meeting of the American Society of Railway Superintendents in New York, Oct. 15, by Mr. W. G. Wattson, Chairman of the Committee on Railway Signaling.

block signals. According to Mr. Prout, of the "Railroad Gazette," who has recently investigated the subject, the English roads carry upwards of 60,000 passengers per year per mile of road operated, and the American roads carry about 5,000, but in proportion to the total number of passengers carried, American roads kill about 16 times as many passengers as the English roads. It would seem from this to be the part of prudence to make haste in the introduction of block signal practice, and also in the interlocking with distant signals of all facing point switches. No investment for insurance will in the long run pay so well. Presidents and managers can consistently consider the cost of block signals as a premium on safety. The essential requisite of any block signal system is safety. The possibility of this requisite is contained in all of the three systems now under consideration, dependent only upon the proper administration or supervision of the service. It is true that this conclusion is disputed by special advocates of the respective systems. For instance, greater safety is claimed for the automatic system, because it eliminates the human agent in the manipulation of the signals, but, on the other hand, greater safety is claimed for the manually operated system, because of the presence of the human agent to serve as a check upon the proper observance of signal indications by enginemen. These claims are largely matters of mere speculation. When safety is assured by several different systems, the important question for individual roads to consider is, which system is adaptable to meet the requirements of their particular service at the least cost, as there is such a thing as paying too much even for safety.

The cost of installation of plant and expense of operating varies greatly between the three systems. The cost of installing the controlled manual plant and the permanent monthly expense for signalmen and repairmen is very great. The cost of installing the pneumatic automatic plant and also the cost of maintenance are greater than that of the controlled manual, but the cost of operation is somewhat less—no signalmen being required. The cost of either of these systems prohibits their introduction on any lines except those enjoying so large a volume of traffic as to overtax the capacity of the telegraph system. The electric automatic system costs less for operation than the controlled manual, and less for installation and maintenance of plant than either the pneumatic, automatic or the controlled manual. However, with the installation of the electric track circuit system, which is the only reliable electric system yet developed, there will sometimes be involved a large expenditure in the preparation of track for its introduction, a thoroughly-drained road-bed and an entire absence of cinder ballast being essential to the maintenance of a reliable circuit. Therefore, under certain conditions the electric automatic system may be as costly to install, maintain and operate as the pneumatic automatic system.

On crowded tracks, where high-speed through express trains, rapid transit suburban trains, accommodation passenger trains, and the various classes of freight trains are moved together, no attempt should be made to get along with anything less than the automatic or controlled manual system. On tracks over which only a moderate traffic is moved—say, not to exceed 60 trains each way per day on double track and not to exceed 30 trains each way per day on single track—the telegraph system will afford protection, without hampering the movement of the traffic. On roads running through thickly settled sections of the country, having stations close together, the cost of introducing the telegraph system would be insignificant, as $50 per station will cover the cost of signals, and the station agents and night operators can generally be utilized as signalmen. On roads running through sparsely settled sections of the country, where the stations are long distances apart and where sufficient station agents are not available for signalmen, the electric automatic system will generally be found to best meet the requirements of furnishing protection at a reasonable rate.

The aim of your committee is to bring home to the minds of railway superintendents the fact that the day for discussing and pondering upon the question as to whether it is best to operate on the open road system or under block signals has gone by, the highest intelligence, supported by experience, in all countries having decided in favor of the block signal practice. The question now is, what block system to adopt.

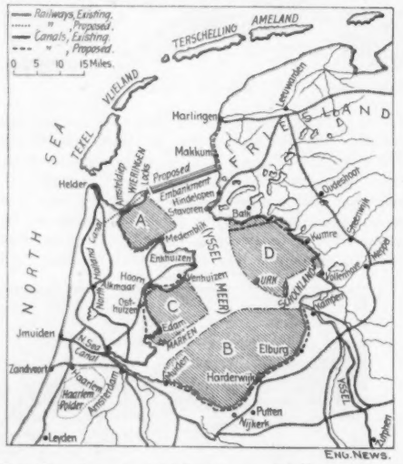
The Brazos River, in Texas, is to be carefully surveyed from Richmond to Velasco, a distance of 85 miles. The survey is to be made under the direction of Major Miller, Engineer Corps, U. S. A., with a view to the permanent improvement of the river and the securing of water transportation for a large section of country.

THE DRAINAGE OF THE ZUIDER ZEE.

The Zuider Zee, which for the last forty-five years has been the subject of a succession of schemes looking towards its drainage and reclamation, is of comparatively recent origin. When the Romans were spreading throughout Europe, the greater part of what is now the Zuider Zee was covered with forests, and as late as the middle of the 11th century a chart of Holland shows that the present fringe of islands to the north, Texel, Vlieland, Terschelling and Ameland, then formed part of the continent. The River Yssel discharged into the North Sea, between the Halder and the present island of Texel; another river, the Vlie, emptied between what is now the islands of Vlieland and Terschelling, and in the center of the forest region was a lake, called by Tacitus the Flevo.

But in A. D. 1170 a great flood occurred, known in Netherlands history as the "All Saints' Day Flood." This flood began breaking down the then existing barriers between the land and the sea and formed the islands of Texel and Wieringen and destroyed the towns of Medemlick, in North Holland, and Stavoren, in Friesland. More floods occurred in 1237 and 1250 and a large part of the land west of Harlingen and Stavoren and as far south as Elburg was washed away, and the island of Vrieland was created. In 1395 further inundations formed the islands of Terschelling and Ameland, and in 1410 the Zuider Zee had practically assumed its present form.

The Zuider Zee is a most dangerous piece of water to navigate. Owing to its numerous shallows, many little more than submerged fields, 7 or



Map Showing the Zuider Zee and Adjacent Parts of Holland.

(The hatched areas show proposed polders or land to be reclaimed.)

8 ft. is the maximum permissible draft for vessels crossing it; and an easterly wind, especially, will render the entire eastern side unnavigable, owing to the danger of being blown out of comparatively narrow channels on to dangerous banks. It was to avoid these dangers that the North Sea ship canal was cut across the peninsula, extending between Amsterdam and Zandvoort, and another canal was cut later through the same peninsula and ending at Ijminden.

In all the reclamation schemes proposed the chief problem was the disposition of the River Yesel, a branch of the Rhine emptying near Kampen, and the inability to come to any definite conclusion regarding this engineering difficulty, delayed work for a number of years. Finally, in 1886, the Zuider Zee Association was formed, with Mr. Buma as president; Mr. Van Diggelan, as vice-president, and Mr. C. Lely as engineer. It was then that Mr. Lely first proposed to build a great embankment across the inland sea, from the island of Wieringen to Friesland, and then form four great "polders," which would drain and utilize the best part of the submerged area and yet leave the deep-water channels as at present. By this arrangement the Yssel and some smaller rivers would empty into an inland lake, to be known as the Ysselmeer, and an outlet for surplus water would be provided by means of locks and sluices near Wieringen.

This proposition was submitted to the government, and in 1892 a Royal Commission was formed to examine it and carry out a still more exhaustive inquiry from every posible point of view. Mr. Lely was now Minister of the Waterstant and was made president of the Commission. After due consideration of the scheme, 21 of the 27 members of the Commission indorsed the general proposition of the Zuider Zee Association, with some increase in the width of the Yssel waterway and the size of the "polders." Mr. Lely first proposed that this waterway should be 4,920 ft. wide, but the Commission fixed upon 16,401 ft. instead, for the reason that, in case of a foreign attack, a width of three miles formed a more insurmountable difficulty in crossing, for an enemy, than a width of one mile.

In considering the scheme in detail, a map is presented, taken from the London "Times" of Sept. 4. The embankment there shown is evidently the most important feature of the work, as its province is to shut out the ocean from the north. According to the scheme laid down, this embankment would be about 25 miles long, and it will take about nine years to build it. The engineers will begin by forming an island on the Breesand, midway on the line, and, when completed, this island is to have a harbor on each side. The next step will be to close the Amstel Diep, between Wieringen and North Holland, and then the embanking will proceed from four different points at once, from the two harbors, from Wieringen and from Friesland.

The foundations of the island and the embankments will be willow branches, loaded down with earth, sand, mud and stone. The bank will be 216 ft. wide at the top and will rise 17 ft. 8 ins. above sea-level at Amsterdam, and the sides will be reveted by stone obtained from Scotland, Norway and Germany. Oak piles will be also used, in a way not plainly explained, for further protection against the highest tides. The highest part of the embankment will be only 6½ ft. wide, near the sea-side; but on the southern side will be a plateau of 56 ft., over which is to be run a highway and a railway for affording better communication between Friesland and North Holland. The Commissioner says that this embankment will be made so strong that its failure will "humanly speaking, be impossible."

There will be two sets of locks at Wieringen, side by side; one will be 32 ft. 10 ins. wide and 320 ft. long, and the other, intended for fishing vessels only, will be 20 ft. wide and 131 ft. long. The size of the larger lock is purposely restricted, so as to prevent hostile war vessels from getting into the Ysselmeer. An elaborate system of sluices, provided with flood and ebb gates, is also planned with a view to raising the level of the Ysselmeer, when this is needed for "military inundations," an important feature in Holland's national defence.

When the main embankment is finished, the work of forming the polders will begin. These polders are simply areas of land reclaimed from the sea by dykes and brought under cultivation. Massive foundations will support these dykes along the dotted lines indicated in the map; and when completed the water enclosed will be pumped out by means of pumping stations on the banks. As the higher parts of the polder become dry, separate embankments may surround these and canals and roads will be established at once, so that their utilization may begin as early as possible. The largest existing area of reclaimed land in Holland is the Haarlem polder, covering 72 sq. miles and having a population of 10,000. But in the proposed scheme the polder marked A would have an area of 107 sq. miles; D would cover 189 sq. miles, and B, 382 sq. miles. The total of the four areas would be 750 sq. miles of good argillaceous soil reclaimed from the sea; and it will eventually be the best land in Holland for agricultural purposes.

It is estimated that the whole work will extend over 33 years, and, under the present arrangement, after the eighth or ninth year about 25,000 acres of land will be thrown upon the market annually for a number of years. The one drawback to the scheme is the absolute destruction of the Zuider Zee fisheries, which now employ about 3,000 persons and 1,500 vesels of all kinds, with an annual revenue of about $830,000. For this loss the Commission suggests an indemnity by supplying craft equipped for North Sea fishing; by insuring these

Zuider Zee fishermen against accident; by pensioning old fishermen and by exempting from all harbor dues vessels owned by former Zuider Zee fishermen. This indemnity has not yet been decided upon and a separate expert commission may be formed to fix it.

The estimated total cost of doing the work included in this project, and including the construction of the embankments, draining the polders, compensating fishermen, etc., is $78,750,000. With compound interest allowed and under the most disadvantageous circumstances that can be foreseen, this cost would rise to $131,250,000; but the capitalized value of the land to be reclaimed is $135,833,330, thus leaving a profit on the undertaking, even on the most unfavorable supposition. The Commission regards the scheme as one proper to be carried out only by the state, and not by individuals; and says that, aside from the question of direct profit from the work, there are indirect advantages of much importance. A whole province would be peacefully annexed to the state; the means of profitable employment would be afforded to thousands, and new sources of taxation for the state would be provided; so that, even if the sale of the lands did not wholly indemnify the state for its work of reclamation, the indirect advantages would far outweigh the deficit. As it stands, it is one of the greatest engineering projects of the century, and the world must admire the pluck and perseverance of the people living in this land "that draws six feet of water"—as Madame de Stael once described it.

THE SAGINAW BRIDGE FAILURE.

We published in our issue of Sept. 27 views of the wrecks of two bridge spans at Saginaw, Mich., one of them a Warren combination truss, built 30 years ago, and which appears for some time to have been standing up only through force of habit; the other a Howe swing span, built about a year ago. Since this publication we have received from authentic sources the inside history of this latter span, and it forms so entertaining a story that we give it, as follows:

In May, 1893, a conflagration swept over the city of Saginaw and one swing span of the bridge crossing the river, which is owned by the Saginaw Union Street Railway Co., was burned. Soon after

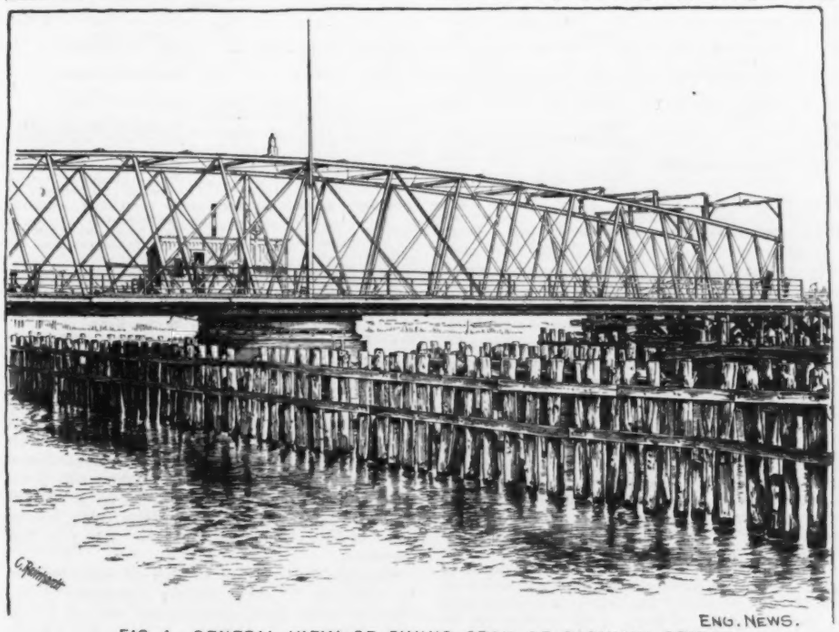


FIG. 1. GENERAL VIEW OF SWING SPAN OF SAGINAW BRIDGE.

the fire the company requested the Toledo Bridge Co. to give them estimates on a span to replace the one burned. The bridge company soon found that the street railway company's idea of price made an all-metal structure out of the question. Mr. Christopher L. Gates, M. Am. Soc. C. E., Chief Engineer of the Toledo Bridge Co., therefore prepared designs for a good metal turn-table and a wooden Howe truss and submitted them, with estimates, to Mr. Hart, the railway company's General Manager. The figures, however, were still much too high to suit the ideas of economy which the officers of the company held, and, after getting other propositions from various concerns, they went to work on their own account, getting castings from some local foundry in Saginaw, and letting the contract for the rest of the work to a carpenter and house builder, who undertook to build the turn-table and bridge from designs furnished him by the street car company managers; and they made use, doubtless, of more or less of the designs previously submitted by reputable bridge builders as they chose. Mr. Gates attempted to warn the managers of the street railway company that they were monkeying with a rather dangerous buzz-saw, and the following is an extract from a letter written to them at about that time:

> Parties who don't know what an angle block is, I feel most emphatically, have no business to figure on bridge work. As to truss rods and other wrought and cast iron, I would draw your attention to the fact that with a bridge figured as light as this one is figured, none but double-refined iron must go into the structure, the truss rods to be upset, not welded, and cast iron to be of best quality.

The railway company went serenely ahead, however, building its bridge as it chose, and Mr. Gates had nothing further to do with the matter and never saw the structure.

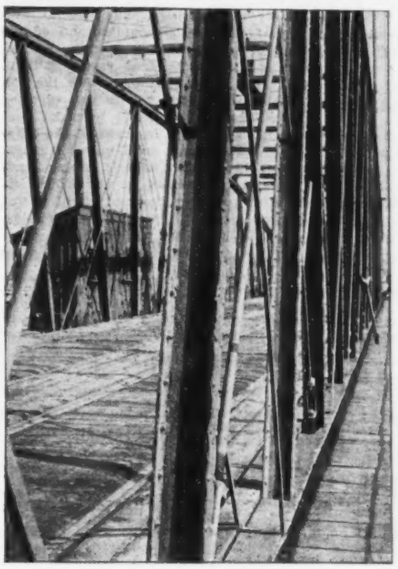


Fig. 2. View Showing Bulging of Cover Plates.

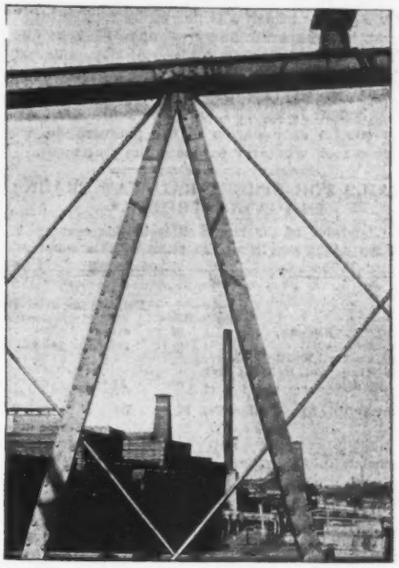


Fig. 3. View Showing Bolted Joint in Top Chord, and Connection of Overhead Bracing.

A SECOND-HAND BRIDGE AT SAGINAW, MICH.

Concerning the wreck of the span, the following extract is taken from a private letter, written by a prominent engineer, describing the wreck of the Howe truss:

> The cyclone last night blew down two spans of Mr. Hart's bridge. The Howe truss swing span, erected by M. C. Heineman, was rolled over, as you would turn over a box—the bottom chords lying on top of the wreck, connected from end to end, forming a good foot-bridge. . . . The turn-table under the wrecked truss was 16 ft. in diameter. It should have been larger, say, 20 or 22 ft. Mr. Hart now claims the wreck was caused in part by a dredge or fleet of scows that were anchored above the bridge. They came down like a fleet of Japanese junks or rams, and were wedged in against the wreck next morning. Had the dredge wrecked the bridge, the truss would have turned round or broken; but the bottom chords were connected from end to end, and it seemed to me as though the structure were lifted by the wind and turned over. It is barely possible that the dredge ran under the south side of the bridge, gave it a sudden shock or lift, and aided the cyclone in turning it over.

From the above statements our readers will have no difficulty in deciding where the responsibility for the failure lies. Fortunately the accident was attended with no loss of life, and as for the financial loss, which falls on the street railway company, the words of Hamlet seem peculiarly appropriate:

> "Oh 'tis rare sport to see the engineer (?)
> Hoist with his own petard."

Since the above was in type we have received from Mr. Henry M. Melchers, C. E., of Saginaw, three photographs of another swing span of this same Saginaw Bridge, which is still standing and doing daily service, although its owner, with commendable prudence, permits only one electric car to cross it at a time.

The general view, Fig. 1, shows the unique style of overhead bracing, a detail of which is also seen in Fig. 3. It will be seen that the panels of this bracing are not of the same length as the panels of the main trusses. This gives variety to the structure and prevents any monotony in its design. In fact, after a careful study of the photographs, one is almost persuaded that these overhead struts are merely put on to carry the trolley wires, and that they are not really intended to serve as lateral bracing at all. Surely if they were

intended to support the trusses against lateral strains, they would never have been stuck up on those ridiculous little stools.

The really delightful features of the bridge, however, are the "upholstering" on the riveted members of the main trusses and the cheerful profusion with which bolts are used in making the top chord connections. We count no fewer than 18 bolts in the top chord connection shown, and only 6 rivets. Apparently the bridge was put up by a "lightning" erector, in a desperate hurry to get to his next job.

The pedigree of this interesting example of bridge engineering is unknown to us. We understand, however, that the present owner of the bridge bought it second-hand some years ago. After a careful examination of the photographs, we see no reason whatever to doubt the statement.

T-RAILS FOR STREET RAILWAY TRACKS IN PAVED STREETS.*

The tendency of the larger cities in this country—in fact, we might say in all the cities of this country—during the past 10 or 12 years has been towards smoother and better paved streets, and the general public, watching the progress of its city officials, has become in many places impatient of the action of the street railway people in maintaining the old forms of rail, which make a ridge on the smooth surface of a first-class modern street in an American city. Our travelers have come home from England and the Continent extolling the grooved rail, and our city officials have in many cases forced either the English grooved rail or its American modification upon the railway companies. No street railway man hankers after the grooved head before he gets it, or enjoys it after he has put it in, and he therefore fights its introduction, demanding to be left alone, as he was, with his center-bearing or 5-in. tram head. What we would show him—and through and beyond him his public—is that he can progress in the direction of their desires for a smooth street, and can give them something even more satisfactory to them than their favorite grooved rail, considering the word "satisfactory," as applying to the point of view of the city and the driving public, as well as that of the company.

For the street railway man, questions of price, joints, quick delivery, competition, coal pile and construction combine to recommend the T-rail. A list of 26 cities in which the T-rail is used, with remarks thereon, is given in the accompanying table, which is compiled from information kindly furnished this committee, by the railway companies, in answer to a list of questions sent out. We might also say that there are over 50 other members of this Association whose roads are reported in the railway publications as being partly or wholly constructed of T-rail, who declined or neglected to answer the inquiries. The general consensus of opinion of these 26 companies, and of the officials of the cities in which they operate, is that if you can once get down a hundred yards of T-rail and make a decent job of the paving, neither the officials nor the citizens will permit you to use anything else in the future. The main thing is to make your paving job a neat and good one. In three of the other cities, where there is at present no T-rail, but which are blessed with enlightened city officials, laying T-rail is about to be made a requirement on the companies.

Modern street railway construction and street paving imply a broken stone, concrete or other solid foundation, a high girder or T-rail and a brick, asphalt or granite surface to the street in the larger cities, or cedar block, cobble or macadam in the smaller ones.

Asphalt or macadam can be paved as easily to a T-rail as to any other. They should be laid flush, and room should be made for the flange by running a railway freight car, or other car having a larger flange than the street car, over the track before it is opened for traffic. Bricks are now molded by many paving brick manufacturers to fit girder and T-rails, those for the latter allowing a space for the flange of the car wheel. Whether it is more expensive to chip the corners of granite or Medina blocks or to leave them intact a short distance from the head of the rail and fill the space thus made with asphalt, creosoted wood or concrete, is open to question, but in either case a first-class job can be made. The writer is familiar with two excellent pieces of 56-lb. T-rail construction on chairs, in one of which the pavement consists of 6-in. cedar blocks, and in the other of small 3-in. or 4-in. cobblestones, both paved close to the rail with no filling.

It may be useful in arguments with city officials in favor of a T-rail as against a grooved girder, to insist that a T-rail is a girder rail with a head differing less from that of the grooved girder than this does from the tram or center-bearing head. The girder is an established fact; its grooved head, we hope, is merely a passing fancy.

* Abstract of a paper by Mr. Strathearn Hendrie, presented at the Atlanta convention of the American Street Railway Association (see also Eng. News, Sept. 6, 1894).

EXPERIENCE WITH THE T-RAIL IN PAVED STREETS.

Railway.	Rail laid in paved streets. Miles of T-rail.	Miles other rails.	Weight, lbs. per yd.	Height, ins.	Style of construction.	Pavement. Inside.	Outside.	Filling.	Remarks.
Augusta (Ga.) Ry. Co.	0.5	3.5	56	3½	Ties, 3-ft. centers, steel chairs.	Brick.	3-in. brick, then asphalt.	None.	Public and officials think it better than girder.
Bay Cities Con. Ry. Co.; Bay City, Mich.	8	11	60	6	.....	.....	.....	Oak strip, gravel, etc.	City Engineer and B of P. W. think it the only rail.
West End St. Ry. Co.; Boston.	24	215	35 to 100	1¾ to 9	Largely 6-in. rail on stringers and 9-in. on ties with tie plate.	Granite block.	Same.	.....	City officials and the public are not in favor of it.
Columbus (O.) St. y. Co.	0.5	54.5	60	6	Ties 2-ft. centers, broken stone ballast.	Brick.	Same.	Hardwood covered with coal tar.	No complaint; more will be laid.
Denver (Colo.) City Cable Ry. Co.	6	....	....	4	Cable; yokes 4 ft. apart.	Asphalt, with stone toothing.	Same.	None.	Makes good street.
Denver (Colo.) Cons. Tramway Co.	6.75	....	48 to 72	3½ and 6	6-in. concrete under ties; concrete between ties.	Stone blocks next rail, then asphalt.	Stone block.	Oak strip, beveled to fit.	.....
Des Moines (Ia.) City Ry. Co.	2	15.23	60	6	Spiked to ties.	Brick.	.....	.....	Public and city officials like it.
Duluth (Minn.) St. Ry. Co.	16	10	....	5¾	ies 2-ft. centers, oak stringers.	Cedar block.	Same.	Block cut or notched.	All like it.
Ft. Wayne (Ind.) Elec. Ry. Co.	8	7	60	6	Ties 2 ft.; tie rods 10 ft.	Brick block, cobblestone.	.....	.....	Company now reconstructing entirely with "T" rail
Houston (Tex.) City St. Ry. Co.	9	1	45	4¾	Ties and chairs and stringers.	Brick, gravel, cypress, bois d'arc, rock.	Same.	Concrete.	Gives satisfaction.
Lincoln (Neb.) St. Ry. Co.	15	....	....	5¾	Ties 2-ft. centers.	Brick, cedar.	Same.	Sand with brick.	Have only two curves now, but intend to lay track.
London (Ont.) St. Ry. Co.	1	11.5	56	4	Cedar ties, gravel and ballast.	Gravel.	Macadam.	.....	Not favored (Note—Pavement is not good.)
Marinette (Wis.) St. Ry. Co.	4	....	40 and 60	3½ and 6	.....	Wood block.	Same.	Wooden strip to fit.	All well pleased now.
Twin City Rapid Transit Co., Minneapolis, Minn.	5	35	60	5¾	.....	Cedar or granite.	Same.	Pine or oak strip.	City engineers approve.
Winchester Ave. Ry. Co.; New Haven, Conn.	14	....	52 to 72	4¼ and 4¾	On chairs and on ties.	Half block, half cobble.	Same.	.....	Common Council will have nothing else.
Norwalk (Conn.) St. Ry. Co.	3	....	60	6	Three brace chairs to each rail.	Blocks and cobble.	Blocks & macadam	....	Gives satisfaction.
Norwich (Conn.) St. Ry. Co.	1.2	....	48	4	Chairs & stringers.	.....	.....	Gravel.	Not favored much.
City Elec. Ry. Co., Port Huron, Mich.	5	....	45	....	Cedar ties, pine stringers.	Cedar block.	Same.	Oak strip inside. pine strip outside.	Gives satisfaction.
Belle City St. Ry. Co., Racine, Wis.	0.227	2.773	....	4¾	.....	Brick.	.....	.....	Public and officials like it.
Salt Lake City R. R. Co.	3	....	72	6	.....	Sandstone block.	Same.	Sand.	Public and city officials well satisfied.
City & Suburban Ry. Co., Savannah, Ga.	1	7	....	....	Chairs or stringers	.....	.....	.....	Not favored.
Springfield (Ill.) Cons. Ry. Co.	22	....	40 and 60	....	.....	Beveled brick or block.	.....	.....	Gives satisfaction. Authorized by City Council.
Springfield (Mass.) St. Ry. Co.	15	....	56	4 and 4¾	On stringers and on ties and chairs.	Granite and cobble	Granite and macadam.	Asphalt and brick.	No complaint; evidently satisfactory.
Waterbury (Conn.) Traction Co.	8	....	....	6 and 7	Spiked; ties 2 ft.	Belgian block for 7-in. rail; cobble for 6-in.	Belgian block.	None.	None better, when properly laid and paved to.
S., W. & A. Ry., Windsor, Ont.	3	1	56	4¼	Steel chairs, ties bedded in gravel then inch board and block paving	Cedar block.	Same.	None.	Preferred to girder rail.
Wyandotte (Mich.) & Detroit River Ry.	2	....	56	4¾	On broken stone.	Macadam.	Same	None.	No objections.

METHODS OF PREVENTING ELECTROLYSIS OF IRON MAINS.

A special committee of the board of public works of New Bedford, Mass., lately visited a number of the large cities of the United States in quest of information regarding the municipal ownership or control of electrical subways. In their report are found the following items respecting the effect of electrolysis on water and gas mains and the methods adopted for preventing it.

Some experts state that the best remedy is to provide an easy passage for the return current, from the water main to the negative terminal in the power house, and say that this can be done by laying a heavy copper wire along the pipe, connected with the pipe by heavy copper rings. Other investigators have lately pointed out that this connection very much increases the amount of current which chooses the water main as a path for its return. This would do little damage were the pipe a good conductor; but, in fact, nearly all lead-calked joints offer some resistance and the current is apt to pass around the joint, and every time it leaves the pipe there will be corrosion.

Another danger coming into prominence is the fact that the current in passing around the joint is more likely to pass inside through the water than outside through the earth. Thus when the current leaves the metal, corrosion takes place on the inside of the pipe. Should the main happen to be a sluggish dead-end, the quality of the water could become more or less effected by the salts of iron or lead deposited.

Philadelphia is trying to prevent these troubles by requiring the street railway companies to conform to very strict specifications relating to the method of laying and bonding the rails, and requires also the laying of extra large return cables, increasing in size as they approach the power house. Several Cincinnati electric railways obviate electrolysis by using two overhead trolley wires. In this way the entire circuit is overhead and through the motors, and no current at all goes to the rails. The objectionable features of this system are the cobweb of overhead wires and the additional complexities of operation.

In Washington, D. C., a conduit electric system is in operation, in which an outgoing and a return wire and two trolleys are used. This construction was forced on the company, as Congress refused it permission to erect overhead wires. The system seems to work well. In the case of New Bedford, the committee recommends that all street railways using electricity be required to give bonds to protect the city from any damage by electrolysis, and that they be compelled to use bonded rails and provide ample conductors for the return circuit.

An iron trestle tower lighthouse has been built on Charles Point, at the entrance to Port Darwin, on the north coast of the colony of South Australia. The center of the tower is an iron cylinder, 6 ft. diameter, on an octagonal concrete base of 10 ft. diameter. There are six columns arranged in a circle of 38 ft. 8⅝ ins. diameter. The feet of the columns rest on iron shoes bolted by 1¾-in. anchor bolts to concrete piers 5 ft. square, extending 2 ft. 9 ins. above the ground. The batter of the columns is 1 in 7. The tower is divided into six panels, the columns being 6 ins. diameter in the bottom panel and 4½ ins. in the upper panels. The horizontal members of the panels are double T-irons connecting the joint sleeves of the columns. At the bottom of the three lower panels these irons are 6 × 4 × ½ ins., and of the upper two 5 × 5 × ½ ins., while at the top of the upper panel is a frame of girders carrying the platform. The diagonal bracing of the panels and the diagonal bracing from panel joints to the central cylinder, are of 1¾-in. rods in the two lower panels and 1½-in. rods in the upper panels, the rods being set up by turnbuckles. Above the platform is the lantern casing, 12 ft. 9 ins. diameter. The height from top of concrete piers to underside of platform girders is 70 ft. 10⅝ ins. The level of the ground is 35 ft. above high water of spring tides, and the height from the ground to the focal plane of the lantern is 86 ft., the focal plane being 121 ft. above sea level. The lantern has a revolving light of the first order, visible at a distance of 18 miles, and flashing every 30 seconds. To the northeast it shows a red light over the shoals for an angle of 42°, and to the southwest, also over the shoals, a green light for an angle of 60°. Seaward the light is bright for 155°, and landward it is observed for 103°. We are indebted to Mr. A. B. Moncrieff, Engineer in Chief of the colony, for plans of this structure and the frame buildings for the lightkeeper.

A 1½-in. cable, 31,800 ft. long and weighing 124,954 lbs., was delivered on Oct. 18 to the Metropolitan Traction Co., at its power house, at Sixth Ave. and 50th St., in this city. Eight more cables are to be delivered, but this one is said to be the largest and heaviest so far received in New York. It was drawn from the foot of 47th St. to the power-house on a 9-ton truck, with broad steel-tired wheels, and hauled by 42 horses.

The extension of Flatbush Ave., in Brooklyn, to the Brooklyn terminus of the East River Bridge, is a question now before a commission appointed by Mayor Schieren. Two plans are being examined by the commission: one proposing a cut across blocks directly from Flatbush Ave. to the bridge, estimated to cost $3,850,000; and another, paralleling Fulton St. at the distance of about one block north, estimated to cost $3,500,000. The new street would be 100 ft. wide and its purpose is to better accommodate the 300,000 people daily using the bridge and the five ferries centering near this point.

The Lake Wrecking & Submarine Navigation Co., of Baltimore, says the "Sun" of that city, expects soon to begin building a submarine boat, invented by Mr. Simon Lake, of Baltimore, Md. The plans are "being kept secret," but if half the claims of the inventor are realized, the "Nautilus" of Jules Verne is to be outdone. Mr. Lake proposes, among other applications of his boat, to use it for laying foundations for bridges, piers, docks, lighthouses, etc. He is to have powerful machinery within the boat capable of lifting, drilling rock, etc. Mr. Wm. T. Malster, President of the Columbian Iron Works, of Baltimore, is said to be financially interested in the scheme.

An irrigation tunnel 4,900 ft. long for the Arrowhead Reservoir Co., of San Bernardino, Cal., was completed on Oct. 6. The tunnel is 6 × 8 ft. in section and connects the Little Bear Valley reservoir with Grass Valley. Work has been in progress on it for two years. A 2,000-ft. tunnel, from Grass Valley to Huston Flat, was completed by the company some time ago, and two other tunnels, 1,700 ft. and 300 ft. long, are under construction. The company is also soon to begin work on a masonry dam 125 ft. high and 700 ft. in length, which will create a storage reservoir three miles in length.

Among the Mannesmann exhibits, at the Antwerp International Exhibition were a set of steel bottles for holding liquid carbolic acid. This liquefied gas exerts a pressure of about 1,000 lbs. per sq. in., but the bottles are all tested to 3,700 lbs. and usually stand a pressure up to 7,400 lbs. before bursting. One of these bottles filled with carbonic acid was permitted to fall across a steel rail from a height of 23 ft. The only damage was a slight dent. Drawn steel tubes for telegraph poles were also exhibited, one of these in a single length of 36 ft.; though poles of this kind are usually made with several offsets, hidden by ornamental cast rings.

The Niagara Falls are 28,000 years old, said Professor Spencer at the late meeting of the American Association for the Advancement of Science. In describing the evolution of the falls, he says that for 11,000 years there was a small fall, of 200 ft., draining the Erie basin, by the present route, the waters of three upper lakes then emptying through the Huron basin by way of the Ottawa River. The second stage came in with the increase in height from 200 ft. to 400 ft. and the final drainage of the upper lakes, and in about 17,000 years more present conditions were brought about. At one time there were three cascades, the lower gaining on the upper until they all united in one great fall. Andrew Ellicott, in 1790, first estimated the age of Niagara Falls, and supposed them to be 55,000 years old. Lyall, about 1841, estimated their age at 35,000 years.

The two boundaries over which the United States and Great Britain are still in dispute lie, the one between Alaska and British Columbia, and the other between Maine and New Brunswick, on the line of the St. Croix River. Both of these boundaries are now in a fair way to be established by joint surveys now in progress. The Alaska-Columbia survey is nearly completed, but until the present season's work is finished and the field notes are worked up, no authentic details can be presented, and the report that Mt. St. Elias is on British territory is, at least, premature. The Maine-New Brunshwick line follows the course of the St. Croix River in and out among its islands and just where it is to be fixed by surveys which are now in progress. The results of these joint surveys are to be reported to two commissioners, representing the two governments; and, if possible, these commissioners are to definitely fix the boundary and mark it by indestructible monuments.

PERSONALS.

Mr. C. K. Perdue, contractor, of Abingdon, Ill., died Oct. 19.

Mr. James Miller, an old land surveyor, died at Shawano, Wis., Oct. 19.

Mr. Lewis Kingman, M. Am. Soc. C. E., City Engineer of Topeka, Kan., has tendered his resignation and will engage in mining in Colorado.

Mr. W. B. Poland has been appointed Assistant Chief Engineer of the Cleveland, Cincinnati, Chicago & St. Louis Ry., with headquarters at Cincinnati, Ohio.

Mr. John Roche, Civil Engineer, who was at one time engaged on the construction of the Wabash & Erie Canal, died at Huntington, Ind., Oct. 16, at the age of 77.

Mr. Phillip Lange, Superintendent of the Newark branch of the Westinghouse Electric & Manufacturing Co., has been appointed General Manager of the company's new and extensive works at Brinton, Pa.

Mr. Everett E. Stone, Division Roadmaster of the Boston & Albany R. R., has been appointed Assistant Chief Engineer, with headquarters at Boston, vice Mr. Walter Shepard, promoted to be Chief Engineer.

Mr. Joseph Herrin has been appointed Superintendent of the Atlanta & West Point Ry. and the Western of Alabama Ry. He was for several years General Superintendent of the Iron Mountain branch of the Missouri Pacific Ry.

Mr. John Henney, Jr., Superintendent of Motive Power of the New Haven system of the New York, New Haven & Hartford R. R., has also been appointed Superintendent of Motive Power of the Old Colony system, succeeding the late James N. Lauder.

Messrs. Daniel M. Wheeler, of Rutland; Grafton Upton, of Dorchester, and Charles E. Page, of Lowell, have been appointed by the Massachusetts State Board of Railway Commissioners as Steam Railway Inspectors, the first two to serve two years and the third for one year.

Mr. Frank H. Olmsted has recently resigned his position as Chief Draftsman of the Sanitary District of Chicago, for the purpose of associating himself with Mr. Burr Bassell, in the firm of Bassell, Olmsted & Bennett, of Los Angeles, Cal., making water supply and irrigation engineering a specialty.

Mr. J. R. Worcester, who has been for the past ten years Chief Engineer of the Boston Bridge Works, has severed his connection with that firm, and has opened an office as Consulting Engineer, at the Exchange Building, Boston, Mass. Mr. Worcester will make a specialty of bridge and structural iron work of all kinds.

Mr. Martin Schenck, ex-State Engineer and Surveyor of New York, has received from the Governor an appointment as Chief of Engineers on his staff. The position is an honorary one, but calls for the services of a civil engineer and carries with it the rank of Brigadier-General. The appointment is made to fill a vacancy caused by the resignation last winter of Prof. Palmer C. Ricketts, of Troy.

Mr. H. A. Wheeler, M. Am. Inst. Min. E., formerly connected with the U. S. Geological Survey and subsequently with the Missouri Geological Survey, has resigned his position as Professor of Mining at Washington University, St. Louis, Mo., and will give his entire time to his business as consulting mining engineer, with an office in St. Louis, giving particular attention to the clay industry, of which he has made a special study.

Mr. Warren Rae Kinsey, Jun. Am. Soc. C. E., formerly with Mr. Gustaf Lehlbach, M. Am. Soc. C. E., and later with Mr. Carrol Ph. Bassett, M. Am. Soc. C. E., in charge of sewer work at Orange, N. J., and Hornellsville, N. Y., has opened a New York office with M. W. L. Hedenberg, C. E., as consulting and constructing civil and sanitary engineers, under the firm name of Hedenberg & Kinsey, with offices in the Downing Building, 106 Fulton St.

Naval Cadets Wm. P. Roberts, of Mississippi, and D. H. Cox, of New York, who graduated Nos. 1 and 2 in the class of 1894, have been ordered to take a two-year special course at the Royal College, at Greenwich, England, preparatory to a transfer to the Naval Construction Corps, U. S. N. It is believed that these will be the last students sent abroad for this purpose, as the Cornell University course in naval architecture, established three years ago, will be sufficiently developed in another year to provide all necessary special training. The first cadets were sent abroad by the United States for education in naval architecture in 1879, and two have been sent since from each graduating class.

Mr. Robert H. Pratt, for more than 13 years Assistant General Superintendent of the Pacific system of the Southern Pacific Co., has tendered his resignation, to take effect in December. He has been with the Central Pacific and Southern Pacific roads since 1865. He was three years foreman of construction on the Central Pacific Ry. and from 1869 to 1871 Superintendent of Track. He was next appointed Superintendent of the Salt Lake Division of the Central Pacific, in which capacity he served until 1878. From that time until 1881 he was Superintendent of the Oregon Division of the Southern Pacific and branches, with headquarters at Sacramento. He was made Assistant General Superintendent of the Pacific system of the Southern Pacific Ry. in May, 1881.

Gen. William Francis Reynolds, U. S. A., who died at Detroit, Mich., Oct. 18, was born at Canton, O., in March, 1820, and graduated from West Point in 1843, in the same class with General Grant. He served in the Mexican War and was in charge of the explorations of the Missouri and Yellowstone rivers in 1850-61. He was Chief Topographical Engineer of the Department of Virginia in 1861 and was made a Colonel and Aide-de-Camp the following year. He was in charge of the defenses at Harper's Ferry during the Confederate invasion of Pennsylvania in June, 1863, and Chief Engineer of the defenses of Baltimore the same month. He was Superintending Engineer of north and northwest lakes, Engineer of Lighthouses on northwest lakes and in charge of harbor improvements in the entire lake region from April 14, 1864, to April, 1870.

Col. James Henry Burton, the expert in small-arms, died at Winchester, Va., Oct. 18. He was born at Spennondale Springs, Va., in 1823. In 1844 he began work in the United States armory, at Harper's Ferry, and afterward received the appointment of Master Armorer, which he held until 1854. In 1855 he accepted the appointment of Chief Engineer of the Royal small-arms factory, at Enfield, England. During the Civil War he was in charge of the Confederate small-arms factory at Richmond, Va. In 1871 he again went to England, at the instance of a private firm in Leeds, to take direction of a contract entered into with the Russian government for the supply of the entire plant of machinery for a small-arms factory on a large scale, at Tula, in Central Russia, for the manufacture of the Berdan rifle, and with the view of ultimately going to Tula as an officer of the Russian government, to take the technical direction of the factory. He returned to Virginia in 1873.

Mr. Julius H. Striedinger, M. Am. Soc. C. E., of San Francisco, Cal., was drowned recently at San Diego, and it is reported that his friends are investigating his death to learn whether it was the result of murder, accident or suicide. Mr. Striedinger was a man of cheerful disposition, and was not financially embarrassed. Early in September he announced to some of

his friends that he was going to Arizona to look after some mining interests there, and has not been heard from since then. He had filled many responsible positions. He was an assistant on the government work of deepening the waters of New York harbor, and worked with Gen. John Newton. He was the engineer who supervised the blowing up of obstructions in Hell Gate. Later he was Chief Engineer of the Magdalena Improvement Co., in the United States of Colombia, and was employed in many of the other South American countries. He was a member of the American Society of Civil Engineers, the Technical Society of the Pacific Coast, and the California Society of Civil Engineers.

SOCIETY PROCEEDINGS.

NEW YORK RAILROAD CLUB.—At the meeting on Oct. 18, there were 14 new members elected. A change in the constitution was adopted by which the Secretary will be employed and his salary will be fixed by the Executive Committee of the club. A paper on "Locomotive Injectors" was read by Mr. Geo. H. Baker, Editor of the "National Car and Locomotive Builder," and was discussed at much length.

ENGINEERING ASSOCIATION OF THE SOUTH.—The monthly meeting was held at the headquarters, in Nashville, Tenn., Oct. 11, Dr. W. L. Dudley presiding. The nominating committee reported the names of candidates for officers and directors to be canvassed at the annual meeting in November. The expected paper on "Diamond Drilling" not having been presented, the discussion of the best and cheapest culverts for areas under 50 sq. ft., begun at the previous meeting, was continued. Hunter McDonald, Secy.

CENTRAL RAILWAY CLUB.—The regular meeting was held on Wednesday, Oct. 24, at the Hotel Iroquois, Buffalo, N. Y. The subject for discussion was Mr. Morford's paper on "Terminal Yards" (Eng. News, April 5, 1894). The following reports were also presented: "Car door fastenings, hangers, brackets. The need for perfect service from the above, and the practical results from various common devices, and recommendations as to good devices that have shown desirable results as to safety and breakages," and "Pistons, piston-packings, piston and valve-stem rod packing; the best in service and comparative cost."

S. W. Spear, Secy.

LIVERPOOL ENGINEERING SOCIETY.—The following is a list of papers to be presented at the meeting of the coming season: "Recent Improvements in Locomotive Design," W. Rowland; "The Whirling and Vibration of Shafts," S. Dunkerley; "The Second Law of Thermo-Dynamics," Oliver J. Lodge; "Tramway Traction," John A. Brodie; "The Theory and Action of Some Automatically Balanced Machinery," W. Worby Beaumont; "The Stability of Ships," H. H. West; "Experiments in Connection with Evaporation," D. B. Morison; "A Scheme for the Distribution of Energy in Towns," F. G. Baily and C. A. Kohn; "Engineering Work and Operations at Perim Island," J. Reney Smith; "Artificial Paving Slabs," Arthur Murker.

ENGINEERS' CLUB OF ST. LOUIS.—At the meeting, on Oct. 17, Prof. Chas. C. Brown addressed the club on "A New Method of Determining Sewage Pollution of Water." He had given the subject a great deal of thought while engineer of the State Board of Health of New York, making a number of examinations of the waters of the Mohawk and Hudson rivers, and later of Mississippi river water in the St. Louis settling basins. He explained how the samples were taken, and showed the construction of the fermentation tube, which was first suggested by Dr. Theodore Smith, of Washington, D. C., and which had for its object the separation of the gas-producing bacilli. The results were quite satisfactory, although the process still lacked much of being an exact science, and much still remained to be done before definite and positive results could be had. Wm. H. Bryan, Secy.

ENGINEERS' SOCIETY OF WESTERN PENNSYLVANIA.—At the meeting held in Carnegie Lecture Hall, Allegheny, on the evening of Oct. 18, Mr. G. E. Tener read a paper on "Lake Shipments of Coal," in which he stated that in 1887 the shipments amounted to 1,854,122 tons, the Pittsburg and Ohio districts furnishing respectively 51% and 49% of this total. The shipments have increased yearly, and in 1892 there were 3,373,462 tons shipped, Pittsburg sending 52¼% and Ohio 47¾%. Last year, owing to the depressed condition of trade, there was a very slight decrease in shipments, as compared with the previous year. Mr. Tener described the various methods of handling coal at the lake ports, and said that until recently but little improvement had been made during the last quarter of a century. Formerly cars containing coal were dumped into pockets with chutes that led to the vessels, but owing to the great waste by breakage incident to this method, it was abandoned. The revolving crane and bucket were then introduced; and, though not altogether satisfactory, on account of considerable waste by breakage, it is the ordinary method now employed. Mr. Tener said that his ideal plan was to have the coal loaded in boxes at the mines, conveyed by cars to ports and placed in boats. The best plan thus far in use was stated to be a machine which runs the car over the vessel on an incline of 60°, and thus, by bringing it closer to the vessel than any other method, the breakage is not so great (Eng. News, Sept. 13.) Mr. William White, Jr., read a paper on "Chemical Losses of Fuel," in which the loss of coal and coke by weathering was dwelt upon at some length and explanations were offered for some of the changes noticed.

BROOKLYN INSTITUTE OF ARTS AND SCIENCES.—At the meeting of the Engineering Section on Oct. 23, a paper on "Some Engineering Features Connected with the Management of the Brooklyn Bridge," was read by Mr. G. Leverich. Referring to the masonry, he stated that the part now being taken down for the extensions proves the excellent quality of the work. The masonry was built by day labor and with Rosendale cement. It is unfortunate that the architectural effect of the masonry approaches cannot be seen to better advantage. Six cables have been used since the opening of the bridge railway in May, 1883. They are 1⅛ ins. diameter when new, and about 1 5-16 ins. when worn out, the wear being mostly caused by the interior wires crushing and cutting into each other, the abrasion of the surface being very slight, owing to the leather and rubber covering of the pulleys and grip wheels. There are four engines, of 250, 500, 750 and 1,000-HP., the latter being a new engine which will not be put in service until the new cable plant is ready for operation. The number of passengers from the opening in May, 1883, to October, 1894, was nearly 339,000,000, and not a single fatal accident has occurred. The first cars weighed 8 and 10 tons; the latest cars, with side and end doors, weigh 19 tons. Electric traction has been investigated, but a great objection is the liability to collision under heavy traffic owing to each motorman having control of the speed of his own train, while with the cable system the speed and spacing of trains are practically regulated by the cable and the train despatcher. He compared the paving of the approaches with that of the city streets, to the marked advantage of the former, as it has been in service for over eleven years without repair or renewal. It may be noted here that the newly paved open space outside the new Brooklyn station is an example of how not to pave properly. Mr. Emery briefly described the Paine grip, in which the wheels are pressed against the cable and revolved by it until a brake is applied to stop the grip wheels and the motion of the cable is then transmitted to the car.

AMERICAN RAILWAY ASSOCIATION.—The autumn meeting was held at the Hotel Brunswick, New York city, on Oct. 17. The attendance was very large, there being over 70 roads represented. The President, Mr. H. C. Haines, being absent on account of illness, Mr. E. B. Thomas, First Vice-President, occupied the chair.

The report of the Executive Committee showed that the membership now consists of 197 companies, operating 145,876 miles of road, an increase of 4,381 miles since the last meeting. It also stated that the Association had been invited by Mr. A. Dubois, President of the Executive Committee of the International Railway Congress, to become a member of the Congress, which will hold its next session in London, in June, 1895 (Eng. News, July 5, 1894). In this connection a resolution was adopted by the Association, authorizing the Executive Committee to accept the invitation, and to take such steps as it may deem desirable to arrange for a proper representation at the meeting. A further resolution was unanimously adopted, inviting Mr. Haines, President of the Association, to represent the Association at the Congress, and authorizing and instructing the Executive Committee to defray his expenses while acting as representative. This action was taken in recognition of Mr. Haines' indefatigable work in promoting the interests of the Association.

The Executive Committee also presented a communication from the Master Car Builders' Association, on the subject of the establishment of standard details in car construction, and the following resolution was adopted:

Resolved, That the details of car construction, adopted by the Master Car Builders' Association, as published with the proceedings of its convention, held at Saratoga, in June, 1894, be and are hereby adopted as standard by the American Railway Association, and all railway companies and car builders are recommended to conform thereto as soon as practicable.

A communication was presented from the American Railway Master Mechanics' Association on the subject of the offer of Purdue University respecting locomotive tests. The committee reported that it had given considerable time to the consideration of the question presented, and had arrived at the conclusion that it was not advisable for the American Railway Association to take up the subject, and that the proper method of conducting these tests should be under the auspices of the American Railway Master Mechanics' Association, and that any funds necessary for that purpose should be contributed directly by the several companies through the medium of that organization.

The committee on "Train Rules" reported progress. The committee on "Car Service" pointed out the advisability of adopting the straight per diem system for compensation and was directed to report at the next meeting. The committee on "Safety Appliances" reported that its time had been taken up in connection with the joint committee on "Interlocking and Block Signals," which latter presented a report somewhat revised from that formerly presented. It simplifies the distinction between telegraph, manually controlled and automatic systems by specifying the essentials of each system and then specifying certain adjuncts to each which may or may not be used, without changing the principles of the systems. The committee on "General Regulations for Employees" presented (without any recommendation) a code compiled from the codes of all the leading railways, and embodying all the principal rules.

The next meeting will be held at St. Louis, Mo., in April, 1895.

AMERICAN INTERNATIONAL ASSOCIATION OF RAILWAY SUPERINTENDENTS OF BRIDGES AND BUILDINGS.—The fourth annual meeting was held in Kansas City, Mo., Oct. 16 to 19, with headquarters at Coates' Hotel. The meeting was called to order at 10 a. m., Oct. 16, by the President, Mr. J. E. Wallace (Wabash R. R.), of Springfield, Ill. Prayer was offered by Joseph H. Cummin, D. D., and speeches of welcome were made by city officials and responded to by members of the visiting association. There were about 60 members in attendance, in addition to a large number of visitors, chiefly prominent railway officials, and 21 new members were elected. The remainder of the morning session was occupied by the annual address of the president, and by other routine business, appointment of committees, etc.

At the afternoon session the committee on "Depressed Cinder Pits," consisting of Messrs. Walter G. Berg (Lehigh Valley), George W. Andrews (B. & O.), R. M. Peck (Mo. Pac.) and Abel S. Markley (Pittsburg & W.), presented an exhaustive report on the subject, classifying and reviewing the existing practice and submitting recommendations. This report was accompanied by a large number of drawings and an appendix, in which the details collected by the committee had been compiled for easy reference.

The committee on "Best Method of Bridge Inspection," consisting of Messrs. G. M. Reid (L. S. & M. S.), J. M. Staten (Chesapeake & Ohio), E. T. Wise (Ill. Cen.) and J. S. Berry (St. Louis Southwestern of Texas), presented a report giving the general opinions, experience and practice of the members. The committee on "Maintenance of Pile and Frame Trestles," consisting of Messrs. W. A. McGonigle (Duluth & Iron Range), J. H. Markley (Toledo, Peoria & Western), George C. Nutting (Charleston, Cincinnati & Chicago) and John Copeland (Chicago, St. P., Minn. & Omaha), presented a large number of blueprints of standard trestle plans with a report in which the subject was discussed under the following heads: 1, Piling, size, kind of timber, best weight of hammer to use in driving; 2, Length of span; 3, Stringers, number size and best timber; 4, Ties, size, length and distance c. to c.; 5, Guard rails, size, length and framing design; 6, Drift bolts and packing bolts; 7, Cast washers and packing blocks; 8, Best method of framing trestles; 9, Economy of preserving bridge timber and best method.

The committee on "The Best Scale Foundation," consisting of O. J. Travis (Elgin, Joliet & Eastern), Jos. Doll (C., C., C & St. L.), C. D. Bradley (St. Louis & San Francisco) and T. M. Strain (Wabash), presented a report giving the individual views and practice of the members, with valuable suggestions and recommendations.

The morning and afternoon sessions of Wednesday, Oct. 17, also the morning session of Thursday, Oct. 18, were occupied in discussing the reports presented by the committees above mentioned. A very large number of members participated in the discussions, especially on the subjects of "Maintenance of Pile and Frame Trestles," and "Inspection of Bridges." On Thursday afternoon the time was occupied by routine business, appointment of committees on subjects for next year's convention, election of officers, resolutions, etc. The convention adjourned at 4 p. m., to meet at Atlanta, Ga., on the third Tuesday of October, 1895.

The subjects for papers to be read and discussed at next year's convention are as follows:

1. Mechanical action and resultant effects of motive power at high speed on bridges.
2. Methods and special appliances for building temporary trestles over washouts and burnouts.
3. Strength of various kinds of timber used in trestles and bridges, especially with reference to southern yellow pine, white pine, fir and oak.
4. Best method of erecting plate girder bridges.
5. Best and most economical railway track pile driver.
6. Sand dryers, elevators and methods of supplying sand to engines, including buildings.

7. Span limits for different classes of iron bridges and comparative merits of plate girder and lattice bridges for spans from 50 to 110 ft.
8. Best method of spanning openings too large for box culverts, and in embankments too low for arch culverts.
9. Best end construction for trestles adjoining embankments.
10. Interlocking signals.
11. Pumps and boilers.

The following officers were elected for the coming year: President, George W. Andrews, B. & O. R. R., Philadelphia, Pa.; Vice-Presidents, W. A. McGonigle, Duluth & Iron Range Ry., Two Harbors, Minn.; L. K. Spafford, K. C., Ft. Scott & Memphis R. R., Kansas City, Mo.; James Stannard, Wabash R. R., Moberly, Mo.; Walter G. Berg, Lehigh Valley R. R., Jersey City, N. J.; Secretary, S. F. Patterson, Concord & Montreal R. R., Concord, N. H.; Treasurer, George M. Reid, L. S. & M. S. Ry., Cleveland, O.

The members visited, by invitation of the Armour Packing Company, the extensive slaughter and packing houses of that company. The lumbermen of Kansas City tendered a reception, at which Mayor Davis, of Kansas City, welcomed the members to the city. The local committee of the Association, consisting of James Stannard (Wabash) and L. K. Spafford (K. C., F. S. & M.), had made arrangements for visiting an number of points of interest, including a trip on the Missouri River, to examine the extensive government river protection work, after the adjournment of the convention. The regular work was not interrupted for sightseeing or pleasure trips, so that the success of the convention from a business point was assured. The papers offered were of a high grade and were well discussed.

AMERICAN STREET RAILWAY ASSOCIATION.—The 13th annual meeting was held at Atlanta, Ga., Oct. 17 to 19, 1894. The President, Mr. Henry C. Payne, of Milwaukee, Wis., called the meeting to order and introduced Hon. W. J. Northen, Governor of Georgia, who delivered an address of welcome, after which the president read his address.

The report of the Executive Committee stated that business in general during the last year has been bad, and the street railway business in particular has suffered, several companies having gone into the hands of receivers, while consolidation still continues to be the trend of the times. While the year has been a hard one, the business outlook is encouraging, and the committee look forward with confidence to a successful year's business. A proposed amendment to the constitution is to provide for the admission of individuals and companies, not street railways, as associate members, under certain conditions; such character of membership having been found conducive to the general welfare of kindred associations. The report of the treasurer showed total receipts, $8,290; expenses, $8,196; balance, $94.

The first committee report presented was on "The Best Method of Treating Accidents and Complaints," which was presented by Mr. P. M. Dyer, claim agent of the West Chicago Street Ry. Co. In the discussion Mr. Payne stated that a company has very little chance before a jury, and the sooner a case is settled the better it is for the company. It does not seem to make much difference what the merits of the case are; if it goes before a jury, the case generally goes against the company. It is only in cases where the points of law are in its favor that the company stands any chance of success. Mr. Shaw instanced a case in which the motorman had his attention attracted by a bicycle alongside of his car at the time that he should have been attending to his duty. There was a car ahead of him that was grounded. He had, however, no reason to suppose that this car would stop or ground in a locality where there were no houses; but, in the moment that he was looking at the bicycle, he ran up against the other car and caused an accident. It was decided to discharge that man, although it was thought a hardship to do so. Mr. Fuller stated that it is a rule of the West Chicago Ry. Co. that one car approaching another car must slow down or stop before getting to it, and if the motorman does not do so, he is discharged. Mr. Shaw said that on his road the rule is to keep cars 500 ft. apart. In the case above where the man was discharged he was within 175 ft. of the other car. If he had been 500 ft. away it would have been different. That was the second instance of a "ground" without apparent cause. The cause was found in the rheostat; the cable had broken and made a contact.

In regard to personal injuries, Mr. Connette, of Nashville, stated that his company investigates the accident immediately after it has occurred. If it finds upon investigation that the company is liable, it then takes care of the parties in the very best way, but if it finds that the company is not liable, it then ceases all expense in the case. Frequently the most trouble is with lawyers, who will hunt up a case and institute suit immediately, without making any effort toward a compromise. The only method found satisfactory in an instance of that kind is to endeavor to settle the case outside of a lawyer, which has been done in a number of instances. When the company cannot settle the case, it is best to keep the matter in court as long as possible, because the longer it remains in court, the more easy it is to effect a compromise. After a case has been in court two or three years, it is easier to effect a compromise than it is at the time of the accident. Another thing of importance is to pursue these cases after they get into court, and endeavor to get such men on a jury as will give a corporation justice.

The next business was the report on "A Uniform System of Street Railway Accounts," by Mr. H. I. Bettis, a brief abstract of which is given in another column. On motion of Mr. Perrine, of Trenton, the new arrangement of accounts was adopted by the Association.

On Friday, Oct. 19, the report on the "T-Rail Construction of the Terre Haute Electric Railway" was read by Mr. Harrison. An abstract will be given in our next issue. In the discussion Mr. Harrison said that brick pavement is much superior in smoothness and durability to granite blocks; but the T-rail can be laid as well and as successfully with the granite blocks as with the brick or asphalt pavement. The concrete foundations are not too rigid, for the riding is perfectly smooth, and there is no jolting or oscillation with the cars, even at the rail joints, special care being taken to make the joints solid. Some roads are not allowing any space for contraction and expansion at the joint, and Mr. Harrison's experience is that there is so much metal below the surface, where it is little exposed to the heat, that there is no trouble from contraction and expansion, as in the case of a girder rail. The joints are Wheeler joints, and rest on the tie, the rails are tamped up with concrete, and the ties are supported with concrete, and the concrete comes up over the tie, so that the rail and the tie both rest on solid concrete, with a heavy bed below, and when the brick paving is put on, and all cemented together, the joints cannot be felt in passing over the track. The result is that the motors and cars last longer.

Mr. M. K. Bowen, Superintendent of the Chicago Street Ry., sent a communication recommending that a committee be appointed to investigate the subject of the validity of patents on articles used by street railways, and it was resolved that such a committee be appointed. The matter of the proposed amendments to the constitution and by-laws, to provide for associate members, was then considered. An informal vote was taken as to the advisability of the adoption of the amendments; and it was the unanimous judgment of the members that the amendments should be adopted. Action on the same will be taken at the next annual meeting.

Mr. Brophy, of Boston, President of the New England Reserve Fund Association, was introduced and spoke on the insurance of electric railway plants. He stated that his is the only mutual company which is carrying electric light and railway properties. It has been insuring electric light stations and power houses for two years, and car houses for one year, and has $7,000,000 of property of this class ($500,000 being on railway property), while for the last ten or twelve months, ending October, the losses have been $2,300 on the $7,000,000. It has been able to pay a dividend of 70% on business written one year ago, all of which goes to show that the electric business is not so hazardous as some people think. The company's rate on electric light stations is 1%. The company does not ask for cement floors or iron floors, nor that the roof shall be 18 ft. high, but it wants a plant that is clean and has no oil on the floors, no finish on the walls, and no attics or basements. A basement or second floor, used for storage, must be equipped with automatic sprinklers. The experience with car houses has been very satisfactory. The basis rate on brick power houses is 1%; frame, 1¼%; car house and contents, including cars; brick, 1¼%, and frame 1½%. A committee was appointed to take up the question of insurance.

The following officers were elected for the ensuing year: President, Joel Hurt, Atlanta, Ga.; First Vice-President, W. Worth Bean, St. Joseph, Mich.; Second Vice-President, John M. Cunningham, Boston, Mass.; Third Vice-President, Russell B. Harrison, Terre Haute, Ind.; Secretary and Treasurer, William J. Richardson, Brooklyn, N. Y.; Executive Committee—Henry C. Payne, Milwaukee, Wis.; W. H. Jackson, Nashville, Tenn.; D. G. Hamilton, St. Louis, Mo.; G. C. Cunningham, Montreal, Canada; J. N. Partridge, Brooklyn, N. Y. The meeting, by vote, decided upon Montreal as the place for the next meeting.

The reports of the committees on "Mail, Express and Freight Service on Street Railway Cars," "Transfers and Commutation," "The Use of the Booster on Electric Railway Circuits" and "Destructive Arcing of 500-Volt Fuses," as well as the paper on "Brakeshoes," were then briefly presented. A committee was appointed, consisting of two members of the Association and one manufacturer, to investigate the subject of the adoption of a standard style of brakeshoes, to conduct experiments and to report its conclusions at the next meeting.

The report on "Power Brakes v. Hand Brakes," by Mr. E. J. Wessels, was read by title (Eng. News, Oct. 18). In discussion Mr. E. A. Sperry said that as the reference to the paper on electric brakes read by him before the American Institute of Electrical Engineers was somewhat unjust, he wished to show wherein some of such errors have occurred. The 14 points in which he claimed the electric brake was superior were taken up by Mr. Wessels in their order, and remarks were attached to each, embodying claims on behalf of the air-brake. For instance, Mr. Sperry's paper said that the use of the electric brake, which does not employ brakeshoes in the operation at all, would cause an entire saving in such brakeshoes, with a resultant saving of wheels from two to three-fold. Mr. Wessels attached to this remark that a good air-brake saves wheels. The air-brake is used simply to increase the power of the application of the brakeshoes, which, while smeared with sand and dirt, attack the rims of the wheels, "drawing" the chills, and very soon grinds off the face of the wheels to a point below the chills, when the wheels will have to be pressed off, and others substituted. The air-brake, instead of saving wheels, simply tends to grind them down sooner by the superior pressure of the shoes upon the wheels, over and above that readily obtainable by hand. With the electric brake the wheels are retarded and brought to rest without the application of brakeshoes, and the rolling contact between the wheel and rail, being the only point of wear, the grinding and ruining of the chill are entirely avoided.

Again, with the air-brake a constant demand for energy is made on the power station, which at the same time may be already well taxed and running up to its capacity. With the electric brake, on the other hand, nothing is used but the momentum stored up in the moving mass, and which in any case we wish to get rid of, the brake simply being a device whereby a part of this energy of motion is used to apply the brake and stop the car.

Referring to the matter of holding a car on a grade after it has been brought to rest, Mr. Sperry said that the car is kept from starting by simply holding the controller handle in the position where the brake is fully applied. The motorman is in this way able to hold a heavily-loaded car on an 8% grade. The holding is perfect, and remains so as long as the handle is in this position. One fact which greatly aids this action is the large friction of quiescence.

The special paper by Allen R. Foote on "Taxation," was then read by title, and the meeting then adjourned.

COMING TECHNICAL MEETINGS.

ENGINEERS' CLUB OF INDIANAPOLIS.
Oct. 27. Secy., C. C. Brown.
TECHNICAL SOCIETY OF THE PACIFIC COAST.
Nov. 2. Secy., O. Von Geldern, 719 Market St., San Francisco.
FRANKLIN INSTITUTE, PHILADELPHIA.
Nov. 2. "A Trip through Germany," by C. J. Hexamer. Secy., W. H. Wahl.
CIVIL ENGINEERS' SOCIETY OF ST. PAUL.
Nov. 5. Secy., C. L. Annan, City Engineer's Office.
ENGINEERS' CLUB OF PHILADELPHIA.
Nov. 3. Secy., L. F. Rondinella, 1122 Girard St.
WESTERN SOCIETY OF ENGINEERS.
Nov. 7. Secy., Thomas Appleton, Lakeside Bldg., Chicago.
ENGINEERS' CLUB OF ST. LOUIS.
Nov. 7. "Progress in Steam Engineering." Secy., W. H. Bryan, Turner Block.
AMERICAN SOCIETY OF CIVIL ENGINEERS.
Nov. 7. Secy., Francis Collingwood, 127 E. 23d St., N. Y.
ENGINEERING ASSOCIATION OF THE SOUTH.
Nov. 8. Hunter McDonald, Nashville, Tenn.
ENGINEERS & ARCHITECTS' CLUB OF LOUISVILLE.
Nov. 8. Secy., G. W. Shaw, Norton Building.
CANADIAN SOCIETY OF CIVIL ENGINEERS.
Nov. 8. Secy., C. H. McLeod, 112 Mansfield St., Montreal.
MONTANA SOCIETY OF CIVIL ENGINEERS.
Nov. 10. Secy., G. O. Foss, Helena, Mont.
WISCONSIN POLYTECHNIC SOCIETY.
Nov. 12. Secy., Geo. G. Mason, 144 8th St., Milwaukee.
ENGINEERS' CLUB OF KANSAS CITY.
Nov. 12. Secy., F. W. Tuttle, Baird Building.
NORTHWESTERN RAILWAY CLUB.
Nov. 13. Secy., W. D. Crosman, Ryan Hotel, St. Paul.
NORTHWESTERN SOCIETY OF ENGINEERS.
Nov. 13. Secy., D. W. McMorris, Burke Building, Seattle, Wash.
CIVIL ENGINEERS' CLUB OF CLEVELAND.
Nov. 13. Secy., F. C. Osborn, 721 Hickox Building.
DENVER SOCIETY OF CIVIL ENGINEERS.
Nov. 13. Secy., F. Ed. King, 36 Jacobson Block.
NEW ENGLAND RAILROAD CLUB.
Nov. 14. Secy., F. M. Curtis, P. O. Box 1576, Boston, Mass.
SOUTHERN AND SOUTHWESTERN RAILWAY CLUB.
Nov. 15. Atlanta, Ga. Secy., F. A. Charpiot, Macon, Ga.
SOCIETY NAVAL ARCHITECTS & MARINE ENGINEERS.
Nov. 15 and 16. Annual Convention in New York city. Secy., W. L. Capps, U. S. N., Washington, D. C.
ENGINEERS' CLUB OF CINCINNATI.
Nov. 15. Secy., J. F. Wilson, 24 W. 4th St.
ENGINEERS' SOCIETY OF WESTERN PENNSYLVANIA.
Nov. 15. Secy., D. Carhart, Carnegie Library Building, Allegheny.
NEW YORK RAILROAD CLUB.
Nov. 15. Secy., John A. Hill, Temple Court, N. Y. City.
ENGINEERS' CLUB OF MINNEAPOLIS.
Nov. 19. Secy., E. Nexsen, Kasota Block.
WESTERN RAILWAY CLUB.
Nov. 20. Secy., C. F. Street, Rookery Building.
COLUMBIAN ENGINEERING SOCIETY.
Nov. 20. Secy., F. W. Hart, Washington, D. C.
ASSOCIATION OF ENGINEERS OF VIRGINIA.
Nov. 21. Secy., J. H. Pilcher, Roanoke, Va.
BOSTON SOCIETY OF CIVIL ENGINEERS.
Nov. 21. Secy., S. E. Tinkham, 36 Bromfield St.
AMERICAN SOCIETY OF MECHANICAL ENGINEERS.
Dec. 3 to 7. Secy., F. R. Hutton, 12 W. 31st St., New York.
NORTHWESTERN TRACK AND BRIDGE ASSOCIATION.
Dec. 14. Secy., D. W. Meeker, St. Paul, Minn.
CENTRAL RAILWAY CLUB.
Jan. 13. Secy., S. W. Spear, East Buffalo Iron Works, Buffalo, N. Y.

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High buildings, considered from a practical and sanitary standpoint, formed a chief topic of discussion at the recent annual meeting of the American Institute of Architects. Mr. Thomas Hastings, of New York, hoped that a legal limitation would be put upon the height of buildings intended solely for revenue, as only by some such action could be obtained that repose or monotony essential to general architectural effect in a city, and required as a background for exceptional monuments. Mr. Geo. B. Post contended that as a problem of design a modern high building was only a tower; and unless the present tendency were checked we would soon have a city of towers, a condition much to be deplored from an aesthetic standpoint. Mr. Post also thought that there was reason to doubt the long life of the steel-framed structure imbedded in masonry. In his own practice he had already found occasion to remove beams on account of rust, though these beams had been encased in solid brickwork. Mr. W. L. B. Janney, of Chicago, took the opposite position as to durability, and said that he had seen steel, in Rome, preserved for 500 years, and a bar of iron, still in good condition, taken from the Egyptian obelisk in Central Park. In other words, durability was in direct proportion to the care exercised in protecting the metal from atmospheric and other injurious influences, and he contended that such protection of steel-framed structures was possible.

Mr. Post also believed that high buildings were not healthful, because bacteriologists tell us that disease germs die in the sunlight and thrive in comparative darkness, and-an increasing number of tall buildings would so shut out the sunlight that all manner of germs might find lodgment and multiply in our narrow streets. This is practically the position which was taken by this journal editorially in its issue of March 22, 1894. In all lower New York there is now a tendency to erect tall office buildings, and the enhanced price of real estate resulting from the fairly tested possibility of obtaining larger revenue from the same ground area tends to encourage the rapid growth of this class of buildings. If this tendency were carried to its logical sequence, we would, within a few decades, have the city of towers and the unsanitary conditions referred to by Mr. Post, and we would also sooner or later have an accumulation of very unserviceable lower-story offices "to rent" with a resulting depression in the value of the property as an investment. The one saving feature in the present craze is the fact that up to about ten years ago desirable office room was at a premium in lower New York, and the supply could not meet the demand. But as each new tall business building provides about three times as many offices as existed in the old structure it supplants, it is a question just how long it will take to catch up with the demand. The enormous outlay demanded by the character of the new class of buildings requires tenants for the new offices, at once and at round rentals; and whenever it becomes no longer possible to find paying tenants to fill such buildings, there will be a falling off in the present rate of construction. But, on the other hand, accommodations in the new buildings are so superior to those found in the older structures that owners may find themselves compelled to meet the modern demand for conveniences under penalty of finding themselves with a highly taxed piece of real estate on their hands with an insufficient rental revenue therefrom. The problem is evidently an intricate one, and while doubtless it will work out its own solution under general laws, it will be interesting to watch the process.

The present steel-frame type of construction for office and other large buildings is likely to have a marked effect upon the continuous output of mills for structural material. As pointed out by the "Iron Age," beam consumption for this purpose was formerly limited to a pretty well-defined building season, the construction of large structures being practically stopped during the winter. Now, these buildings are run up with little or no regard to the season, and the demand upon the mills is, for this reason, more evenly distributed throughout the year, and with a moderately steady activity the actual output would be greater in tonnage than under the old system of alternating rush and complete stoppage. The price of beams is now exceedingly low, ranging from 1.25 to 1.35 cts. per lb. for the common sizes in the leading markets, and our expert contemporary does not believe that a much higher price could long prevail, owing to the enormous reserve capacity and the tendency of old mills to remodel their plants in the direction of greater capacity and faster work. But, on the other hand, there is the prospect of a rapidly expanding consumption, due to low prices and the fact that, owing to low cost, beams are being used in new directions, in the better class of dwellings and in smaller store buildings. This tendency, already pronounced, is likely to develop steadily, and ultimately consume a large tonnage produced at moderate cost, but on the safer basis of a steady, instead of a spasmodic, market.

In the same issue the "Iron Age" also points out the present close agreement of the English and American prices for bridge material for distant markets. From late English quotations on work of this character the prices per pound for steel ship plates ¼ in. thick and over ranged from 1.09 to 1.224 cts. f. o. b. on the Tyne or at Liverpool. Steel angles, in the same estimates, ranged from 1.032 to 1.197 cts., with the same prices exactly for iron ship plates ¼ in. thick and over. During the current year steel ship plates and angles have sold in Philadelphia and New York as low as 1.15 and 1.20 cts. per lb., or very nearly the prices of the English material in Hull and Liverpool. As our contemporary says, there is this important difference in these prices, that while the English makers are probably selling at some profit to themselves, the American figures quoted may represent a sale at less than cost in a period of extraordinarily low prices for raw material and with wages below a fair and usual level. But with a tendency to low prices, taken in connection with the better systematized shop methods of American bridge builders and cheaper and yet efficient types of American design, there would now seem to be a better field abroad for American bridge work than ever before. As an example of one item of structural expense that would not figure in the bids of an American constructor, we would refer our readers to "The Engineer" of Sept. 21 last. There is shown a photograph of a road bridge, built for Brazil by the Cleveland Bridge and Engineering Co. This bridge is about 460 ft. long and 33 ft. wide; but the interesting feature is that, to insure its accuracy of workmanship, the bridge was temporarily erected, complete, at the works in England, where it was built, and the photograph shows it at these works. The expense of this kind of a test of workmanship is no inconsiderable item in the general account; and the American bridge builder would eliminate it altogether by a simple guarantee, fully warranted by his much more accurate and certain method of shop practice.

Little has been heard for some time of the Winnipeg & Hudson Bay railway scheme, which was pushed so indefatigably by its promoters in the flush times of 1887 and 1888. In the October number of the "Canadian Magazine" Mr. Hugh Sutherland, who has been identified with the scheme from its inception, explains in detail the advantages which the route would offer. As many of our readers will recall, the purpose of this railway would be to carry the wheat product of the Northwest to a shipping port, which would be established at the mouth of the Nelson River. Mr. Sutherland presents some evidence in support of his claim that the navigation of Hudson Strait it attended with only insignificant risk during some four or five months of the year, and is navigable with no greater risks than are regularly encountered by Arctic whalers during all the year save the winter months. There is no doubt that the Hudson Bay route would furnish a much shorter route for the export of grain to Europe from the fields of Manitoba than any other possible one. If the current of trade were once established over that route and proper facilities were provided for the navigation of Hudson Bay and Strait, in the shape of lighthouses, etc., and with wharves, elevators and other facilities at the terminal port, there seems reason to believe that grain could reach the British Isles more cheaply than by any existing route. On the other hand, the doubts concerning the navigation of the Strait, and, more important still, the doubt whether traffic could be induced to change its course to so great an extent and to pass through so inhospitable a climate, are likely to prevent private capital from enlisting in the enterprise, at least for a long time to come. As for government aid, all the Canadian provinces east of Manitoba have every reason not to divert the current of traffic, which now uses their railways and canals, even if the condition of the Canadian exchequer would permit such an experiment. Manitoba itself is far too poor to furnish the money for so vast an undertaking, and her past experience in subsidiary railway schemes has not been such as to persuade her to make further ventures in that line. As far as can be seen, then, the Hudson Bay route is likely to remain a promoters' dream for years to come, or until its commercial advantages are much better established than they are at present.

THE AIR-BRAKE PATENT LITIGATION AND ITS LESSONS.

As announced more in detail on another page of this issue, the decision of the court of last resort has recently been handed down, sustaining the Westinghouse patent on the quick-action triple-valve, and finally ending, it is to be presumed, the litigation which has so long been carried on over this patent. We have elsewhere explained the scope of this decision in detail. Its effect is to secure to the owners of the Westinghouse patents that sole use and control to which they are entitled by every consideration of justice and equity. We shall be disappointed if this important decision does not have, in some degree at least, the further result of restoring confidence in the American patent system, and increasing the general respect of the public for the property rights which our patent laws confer. It is this latter phase of the subject which we now propose to discuss, for no better example has for a long time occurred of the need of a better understanding of the status of patents by men of affairs, and especially by engineers.

An idea has been steadily gaining ground during the past score of years or so that the patent system is a kind of exploded fallacy, and that any patent can either be "got around" by a little shrewd designing, or can be boldly infringed, and the law's delay can be relied on to protect the infringer from the necessity of making restitution.

Perhaps this idea is as common among engineers as among any class of men; and though those engaged in engineering pursuits are probably the greatest users of and beneficiaries of the patent system, there are numbers who profess contempt for the patent system, and who apparently feel under no moral obligation to obey the property rights which the patent system confers. In plain terms, there are thousands of reputable business men who would as soon cut their right hand off as to steal their neighbor's "goods, chattels or estate," who yet would have not a trace of compunction in appropriating his property created by the patent laws.

While the moral aspect of the question is apart from the main lesson taught by the air-brake patent cases, a word or two in reference to it may not be out of place. Probably every good citizen would agree that to be "law abiding" is among the first essentials of good citizenship. Now, a law-abiding citizen is under quite as much obligation to obey the laws protecting private property as to obey other laws of the statute book. The patent law establishes a certain species of private property, and when it is recalled that the whole institution of private property is founded upon and dependent upon law in some form, it is not apparent that the property rights created by the patent law are any the less deserving of respect than property rights of any other class.

But, it is argued on the other hand, that the patent law was devised to cover an embryo stage of civilized industry compared with that in which we are now living. Given a certain piece of work to be done, and there are hundreds of mechanical designers who will plan a machine to do it with the same certainty of success as a man would go to work to forge a horseshoe or dig a garden. In other words, the origination of new mechanical combinations is a systematic process, which any adept in it can perform. Why, then, should the man who first happens to make use of a certain combination be given the exclusive right for a period of years to use it?

It would be idle to deny that there is more or less truth in this view of the case; but, on the other hand, such an analysis overlooks certain facts of importance. It is true in a certain degree that in many lines invention proper is a much more mechanical process than it was in the early years of the century; but while the rewards which the patent law offers are not so necessary now to stimulate the work of the inventor, they are vastly more necessary to stimulate the promoter, the capitalist and the business man to take up the inventor's idea and educate the public with respect to its value and importance.

The Westinghouse triple-valve patent is an excellent illustration of this. When Mr. Westinghouse invented the quick-action triple-valve, he made a step of great importance in the development of the art. The mere invention involved comparatively little time or expense, and there might be some reason in contending that merely because a man worked out this successful idea a day or year before another man, is not a valid reason why the former should have a 17-year monopoly of its use. On the other hand, it must be remembered that following this invention Mr. Westinghouse and his associates built and tested the new device on a large scale. They worked out the numerous and complicated problems involved in its design. They took measures to bring it to the attention of railway officials the country over, and to have it placed in service under conditions which would aid its success, employing a large staff of expensive experts to watch its working and correct any fault. Finally, they invested a large amount in special machinery to make freight car air-brakes on a large scale at a smaller cost and with far greater perfection than they could possibly be made for in an ordinary shop with ordinary machinery. That they would never have undertaken this large expense had the invention not protected by patent, goes without saying, for there would have been no object in working up a market and establishing a business to be taken by others at the end.

But this work of educating the public to the merits and importance of a new departure—this establishment of the new industry—is a work which is eminently for the public benefit. It is no exaggeration to say that the benefits which have already accrued to the railway and shipping public as a result of the development of the quick-action freight brake amount to millions of dollars. It appears, then, that the patent law does operate for the public benefit; and if this be admitted, it must also be admitted in fairness that all law-abiding citizens are under a moral obligation to respect the property rights which it creates.

So much for the moral aspect of the question. Let us turn now to the interesting object lesson presented by the patent litigation which has just been brought to a close:

As related above, following the completion of the invention by Mr. Westinghouse, the Westinghouse Co. proceeded to exploit it and were very soon successful in securing large orders. It soon became evident that the freight cars of the country were destined to be equipped with automatic air-brakes, and the profits involved in this enormous volume of business excited the cupidity of other brake manufacturers. That Mr. Westinghouse was really the inventor of a revolution in air-brake practice they knew perfectly well and have so acknowledged in court. That he had reduced his invention to practice in a most thorough manner and had accomplished the work of bringing it before the public with commendable zeal, was also well known. But these rival brake companies thought that the patents which protected the Westinghouse Co. in the investment it had made could be "got around," and so they began a struggle to enter the field as competitors of the Westinghouse Co. The defense which the New York Co. has presented in court has been simply and solely a claim that Mr. Westinghouse did not obtain from the patent office such a broad and comprehensive title as was his just due by virtue of his work as a pioneer inventor, and that, therefore, by reason of this alleged flaw in the title, the New York Co. could lawfully infringe his rights.

Such a basis was manifestly a poor one on which to found a successful business enterprise, and the sequel has amply proved this to be the case. The New York Co. entered the market determined to "get business" at any price; and, in its haste to get into the market, it made the serious mistake of forgetting Davy Crockett's admonition. The first triple-valves which it put into service proved to be seriously defective, and this was a serious blow to the company's reputation. The valve which was brought forward in its place was not proved to be the equal of the Westinghouse valve. In general, we understand that the output of the New York Co. has only been salable at prices so far below those for Westinghouse equipment, as to leave very scant margin of profit. Its total volume of business, however, has been by no means large, so far as information is available, and altogether its lot from the outset of its career has been far from "a happy one."

We allude to these facts merely to add force to the salutary lessons which the unfortunate experience of this company teaches, and which seem to be much needed at the present time. There are many men in the business community who have a superficial knowledge of the patent law and its administration, and who have come to believe that the infringement of a patent is a trivial matter, and that the uncertainties and delays of patent litigation are so great that in the event of a suit by the injured party they can run a free course for years, with a fair chance of eventual success, and if beaten in the end, can yet succeed in escaping the payment of compensatory damages. To those who have such ideas, and who are acting upon them in their business, the result of the air-brake litigation should serve as a warning.

It will, of course, be understood that in referring to the moral and legal obligation to respect the rights which a patent confers, we are alluding only to valid and bona-fide patents. It is common knowledge that a great number, probably the great bulk, of the patents which are issued, really bestow no right of any value whatever. A patent may be well compared to a deed of real estate. It covers the territory which is defined within its claims—no more; and only a search of the records can show what are the probabilities that the title is a valid one. But because there are thousands of deeds which cover land of no value, or land to which the chain of title is defective, it does not at all lessen the value of a deed which conveys a good title to a piece of income-yielding real estate; and so a patent granted to the actual first inventor of a real improvement in the art to which it pertains, and so drawn as to cover the improvement and protect it from trespass, is of value in proportion to the income which the invention it covers can be made to yield.

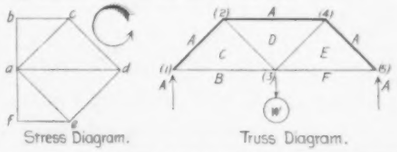
We hear much of the uncertainties of patent litigation, and there is more or less impression that success in such suits goes with the possessor of the longest purse. It is true, indeed, that such litigation is expensive, and that its delays are apt to be disappointingly great. On the other hand, it must be admitted by every one familiar with the subject that the able judges who conduct the United States Courts administer the patent law with remarkable ability and fairness. Patent cases abound with technical and legal complications, which tax the ability of the best lawyers and the most competent technical experts; and in the majority of patent cases which come before the courts, ascertaining where actual justice lies between the two parties is a difficult matter. The man who enters patent litigation with a doubtful case may, of course, be said to be entering a lottery; but the man who can show to the judge a clear case in his favor has no greater certainty anywhere of securing a fair and impartial hearing and a just verdict than in the trial of a patent case in the United States Courts.

LETTERS TO THE EDITOR.

A NEW METHOD OF DETERMINING THE CHARACTER OF STRESS.

Sir: In your issue of Oct. 11 appeared an article by Mr. La Rue on a New Method of Determining the Character of Stress. The convention consisting of two arrows pointing away from each other is there employed to denote compression and the opposite for tension. As this is directly opposed to the natural relation between the convention and the thing to be designated by it, confusion is liable to result. The method of placing arrows on stress diagrams has been employed before, but it has been customary to regard the direction of each arrow with reference to the adjacent extremity of the line, considered as a joint, tension being indicated when the arrow points away from the extremity and compression when the arrow points toward it.

The best method that has yet come to my knowledge may be briefly described as follows, the same diagram being used as that in the article named:



It will be observed that in laying off the external forces A B, B F and F A, on the load line a b f a, that the forces were taken in the order just given—that is, in regular succession when passing around the truss diagram in the direction indicated by the circular arrow placed near the stress diagram. Now, in order to find the character of the stress in any member, as D E, pass around the joint 3, in the direction of the circular arrow and notice that the letters then come in the order E D. Observe the direction from e toward d on the stress diagram (upward toward the right) and transfer this direction to the member on the truss diagram. It is seen to be away from joint 3, and thus shows the stress to be tension. If the joint 4 be selected, the corresponding order of the letters is D E, and the direction from d to e, when transferred to the member at this joint, also indicates tension. All the members meeting at joint 3 are found to be in tension. The application of this method remains simple even when the stress diagram is very complicated in form. By properly selecting the joints, the labor involved is materially reduced. In this case the stresses in all but three members may be found at joint 3. No arrows whatever need be marked on the lines of either diagram. In case several stress diagrams are drawn on one sheet, a circular arrow should be placed adjacent to each diagram, as it may be desirable to lay off the external forces in different directions.

Truly yours. Henry S. Jacoby.

Cornell University, Ithaca, N. Y., Oct. 17, 1894.

Sir: In the paper by Mr. Benj. F. La Rue, with the above title, in your issue of Oct. 11, the author states: "The method is so very simple that it is remarkable that it has not been previously noted and used." The writer has used his method of determining the character of stress during the past six or seven years with

his classes, at the Pennsylvania Military College, and has invariably required the students to indicate the character of the stress in a truss member by arrows, as shown in the illustration accompanying Mr. La Rue's paper. This method is the only one whereby the student can arrive at a clear idea of the meaning of the stress diagram, and is probably the one that is in general use by instructors of graphical statics.

Sincerely yours, Silas G. Comfort.

Chester, Pa., Oct. 13, 1894.

Sir: If Mr. La Rue will consult a work on "Graphic Statics and the Construction of Trussed Roofs," by N. C. Ricker, pp. 67 and 68, he will find his method explained. Yours, W. F. Kendall.

Green Bay, Wis., Oct. 15, 1894.

Sir: In an article entitled "A New Method of Determining the Character of Stress," published in your issue of Oct. 11, the author says:

"This method is so very simple that it is remarkable that it has not been previously noticed and used."

The method has been employed by the writer in class instruction for 16 years. However, it has not been published, except in blue-print manuscript.

Ira O. Baker.

Prof. of Civil Engineering, University of Illinois.

Champaign, Ill., Oct. 19, 1894.

(In publishing Mr. La Rue's method, we thought it very probable that it was not an entire novelty; but it is one of the chief purposes of this journal to make public for the general benefit of the profession just such labor-saving methods as this; and whether they have been used in one or a dozen places detracts not at all from their value, so long as they are not generally known and practised in engineering offices. We make this explanation in order that none of our readers who may have any piece of professional knowledge in their possession which they ought to make public shall hesitate to do so for fear it may not prove an entire novelty.—Ed.)

FORMULAS FOR EARTHWORK COMPUTATION.

Sir: In the fourth paragraph of my letter in your issue of July 26 (p. 73), the formula for the correction of a sloping section, which had been reduced to a level one, is given as $d\,r^2$. This, of course, should be $d^2\,r$. In the letter of Mr. Cornwell in your issue of Aug. 9 (p. 113) he states that he has among his papers "exactly the same formula for calculating earthwork quantities," but the method of using it, as described by him, is so different from my method, that I think he must be mistaken. For instance, suppose the center height of a cut is 4 ft., and the side heights 2 and 10 ft. His method appears to be to compare the sum of the side heights (= 12) with twice the center height (= 8), giving a difference of 4.

Now this difference (4) is to be multiplied by a tabular number, and the result added or subtracted, "as the case may be, from the cubic area column." My method is simply to take one-fourth of the sum of the side heights and twice the center height, which would give $\left(\frac{4}{2+8+10}\right)$ a new height of 5. The difference by my method would be 1, and I take a correction corresponding to a value of 1, directly from a table, without any multiplication. Further, my correction is never added, but always subtracted.

Mr. Cornwell has also made a mistake in quoting his formula for longitudinal correction. If "H" and "h" represent the end heights of a prismoid, the formula should be $\frac{(H-h)\,(H-h)}{6\times 27}\,L$, and should be subtracted, if he used the cubic yards corresponding to the end heights of the prismoid, as his letter indicates.

Some 15 years ago an engineer on the A., T. & S. F. R. R. showed me some manuscript tables, which were used on that road. A few years later these were extended so as to embrace various slopes and widths of roadway, and were published in book form by Messrs. Pullen & Chandler. My recollection of these tables is that they differ very slightly, if at all, from those described by Mr. Cornwell. I agree with Mr. Cornwell that it would be cruel just at present to inflict three books on railway engineers, telling them how to calculate quantities, when they cannot get any quantities to calculate; but if he wishes to form a trust or pool, I think it would be more appropriate for him to suggest it to Messrs. Pullen & Chandler. I have no feeling of jealousy toward any engineer who wishes to write a book and explain his method. The engineers into whose hands the various works will fall will be the jury to pass on their respective merits, and it will only be a question of the survival of the fittest. The game is open. Come, gentlemen, "Ante and look pleased."

Yours truly, Arthur Pew,
M. Am. Soc. C. E., M. Inst. C. E.

Macon, Ga., Aug. 15, 1894.

Sir: Desiring to consume as little space as possible, I intended to let the subject of earthwork computations end with the one letter in your issue of July 26, though Mr. Pew brought up new matter which might have been considered. Mr. C. L. Cornwell's letter in the issue of Aug. 9, however, makes a few additional words the more necessary.

My only objects in writing my first letter were to show in the interest of history that the Thielson formulas are old and to show in the interest of science that they are worthless. Their age is well established and their worthlessness appears on their face. They are their own condemnation. They are indirect, roundabout, unphilosophical and unreasonable, and I claim no part or lot in them.

Notwithstanding all this, Mr. Cornwell reproduces substantially the Thielson formulas and then refers to them and to mine as "similar formulas." Mr. Cornwell is too generous. I cannot accept the compliment.(?) Having from the first condemned the Thielson formulas, I cannot now father them or fraternize with them.

That Mr. Berrian in his old age sent for the relic scarcely proves him a judge of earthwork; whereas his being obliged to call in an assistant to compute tables for him (in which he was grievously imposed upon) proves positively that he was no judge at all. That Mr. Thielson did not publish them shows his opinion of them. The worst thing known about him is that he made those tables. The best thing known about him is that he had too good judgment to publish them. P. H. Philbrick.

Lake Charles, La., Aug. 20, 1894.

A STANDARD "BELL" FOR CAST IRON PIPE.

Sir: I take the liberty of presenting a plea for concerted action of engineers and pipe founders looking to the adoption of a uniform bell for the different sizes of cast iron pipe. At present the engineer, in preparing his specifications, calls for a certain depth of bell and thickness of lead room. Oftentimes the pipes yarded at the foundry during the previous winter, which the successful bidder could apply to the contract, have bells unlike those called for in the specifications.

In many cases the foundry stock is accepted chiefly on account of the saving of time in the delivery of pipe, which is the one thing more than any other that delays construction. This acceptance at once causes a deviation from the specifications and establishes at the outset of the work a very dangerous precedent.

The writer considers it an unnecessary condition that pipe be made specially for a particular piece of work, excepting for large contracts, for if this condition was specified and rigorously adhered to by all engineers, then all pipe above or below the 3% variation would be lost to the founder. Three per cent. is mentioned because there is a tendency to get as much tonnage as possible, and the variation may run the cost of the work above the appropriation, which is usually cut down to the lowest notch. If the founder is allowed to apply his yarded pipe to any contract, then he can place the different weights more closely.

Many standards have been suggested, but up to the present time no action has been taken. The writer will not attempt to propose a standard, but thinks the tendency is to have the bells too deep. At Winchester, Va., we accepted some 10-inch stock pipe with a depth of bell of 3 ins., in order to gain time in delivery. We applied a pressure of 260 lbs. per sq. in. direct from the engines and did not start a single joint. The lead was 2 ins. deep and 7-16 in. thick. The smaller the bell permissible, the greater the pressure a pipe with a weight of x pounds per foot will resist, because the excess of material in the larger bell is distributed throughout the length of the other pipe. The writer trusts that this letter will awaken an interest and promote a discussion on the subject which will finally lead to the adoption of a recognized standard. Alexander Potter.

New York, Oct. 15, 1894.

SUBJECTS FOR THESES.

Sir: A good field for experimental work by an undergraduate would be to test the carrying capacity of flowing water under various conditions of velocity, extreme temperatures, form and kind of channels, giving specific gravity, quality, quantity, etc., of material conveyed, such as silt, sand, gravel, loam, clay, etc. This is a subject of much practical importance and there is very little available information upon it.

Another important field for investigation is the friction of large rollers. We have some data on very small rollers, but of questionable value; the whole subject is worthy of a thorough study.

I would point out the necessity that in any such investigation useful and practical results should be sought for, rather than abstruse mathematical discussion.

Yours truly, C.

Philadelphia, Oct. 18, 1894.

AMERICAN PORTLAND CEMENT.

Sir: In the chapter on "Minerals & Mining," in Prof. N. S. Shaler's work, entitled "The United States of America," we find the following paragraph:

The ordinary limestones of this country produce, on burning, an excellent mortar and many of the strata, particularly those of Silurian age, afford materials which can be manufactured into hydraulic cement.

Owing, however, to a curious lack of enterprise in the production of this last-named material, the American hydraulic cements are still excelled by those which are manufactured in Great Britain and Germany. This defect is probably not due to the lack of the original quality of the cement rocks, but to the fact that this industry has received less attention from our American inventors than any other part of our important economic work.

We regret very much that he should touch on American cement without investigating the quality of that manufactured in several parts of the United States. The fact that cement is manufactured in this country, fully the equal to any made in Europe, cannot be denied by any one who will take the trouble to look into the matter.

The ocean freights from Europe to Boston have been so low and the railway rates so high from the Portland cement mills in the Lehigh, Pa., cement region, the Syracuse, N. Y., cement region, and the Ohio cement region to points in New England, that it has been impossible to market much high-grade American cement in the New England states. In other places, however, notably in Philadelphia, there has hardly been a work of any magnitude, in recent years, which has not been constructed with American Portland cement. Take, for example, the following list: Drexel Building, Wilson Bros. & Co., Engineers and Architects; Reading R. R. Terminal Station, Wilson Bros. & Co., Engineers and Architects; Pennsylvania R. R. Station, Furness, Evans & Co., Architects; Harrison Block, Cope & Stewardson, Architects; Odd Fellows Hall (under construction), Hazelhurst & Huckel, Architects; Philadelphia Bourse Building (under construction), G. W. & W. D. Hewitt, Architects.

The third annual report of Edwin S. Stuart, Mayor of Philadelphia, shows that American Portland cement held its own with the foreign brands, as can be seen by the accompanying table.

In New York City the foundations of such buildings as the Manhattan Life Insurance Building, which is the highest building in America, were built with Portland cement from an American factory. Upon the New York docks, the construction of which has been going on for many years, American Portland cement is now in use.

In St. Louis the Water Department is now using Portland cement of American manufacture, the latest specifications calling exclusively for American Portland cement.

It is well known to all who have carefully watched the progress of American Portland cement that it has only won recognition after the most exhaustive tests, and after being found not only to have strength equal to the best foreign brands on short-time tests, but on long tests, covering a period of from three to ten years, it has shown a greater increase of strength than the foreign.

We wish to bring to mind that for a number of years, many prominent engineers have acknowledged

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Laboratory for the Inspection of Cements: Average of Neat Cement Tests for the Year of 1893.

Brand.	Fineness, No. 50 sieve.	Samples. Collected.	Samples. Rejected.	Briquettes. Molded.	Briquettes. Broken.	Average tensile strength, lbs. per sq. in. 24 hrs.	7 days.	21 days.	2 mos.	3 mos.	4 mos.	6 mos.
Alsen (German)	99.38	2	..	16	16	204	435	490	603	615	..	..
Dyckerhoff (German)	99.52	33	..	264	226	228	446	526	557	561	574	647
Burham (English)	95.52	55	5	420	361	157	360	445	493	511	540	591
Brooks' Shoobridge (English)	96.25	2	..	24	18	143	352	526	..	..	..	..
Saylor (American)	100	15	..	120	84	153	413	540	..	602	..	..

American Portland cement to be of the very best quality. Q. A. Gilmore, Brevet Major-General, U. S. A., after testing the cement on exhibition at the Centennial Exhibition at Philadelphia, 1876, said: "American Portland cement stood among five of the best specimens tested." George S. Green, Jr., Engineer-in-Chief, N. Y. Dock Department, wrote, in 1879, that they had used 9,598 bbls. of American Portland cement, and he could recommend it for any purpose where Portland cement was required. Capt. James B. Eads, when building the concrete jetties at the mouth of the Mississippi River, selected an American Portland cement, the testing of which was carried on by Mr. E. L. Corthell, and from the results of this testing Captain Eads said he was "justified in saying that it is equal to any of the foreign brands." G. L. Gillespie, Major of Engineers, U. S. A., wrote, in 1883, that in making the selection of cement to be used in the concrete jetties at Sandy Hook, he finally decided to use American Portland cement, all of which proved of superior quality.

In the face of these facts, which are of easy access to any one willing to investigate the matter, and the fact that there were about 500,000 bbls. of Portland cement made by the American factories last year, of equal quality with the imported cement, we feel that Professor Shaler's statement in a work of such prominence will do the American cement industry a great wrong if it stands uncorrected.

Yours respectfully, Wm. G. Hartranft,
Vice-President Commercial Wood & Cement Co.
Philadelphia, Oct. 17, 1894.

NOTES AND QUERIES.

C. M. C. asks where information can be obtained concerning the properties and value of marl. According to the article on this subject by Mr. John C. Smock, in "The Mineral Industry for 1893," the amount of marl used as a fertilizer has greatly decreased during the past score of years, owing to the competition of artificial fertilizers, the effect of which upon the soil is more quickly felt. The New Jersey marl beds produced some 153,000 tons in 1890 and about 110,000 tons in 1893. In the latter year the amount sold was about 11,500 tons. The great bulk of the marl is dug by farmers and used on their own lands. When sold it brings from 25 cts. to $1 per ton, but very little is sold at the higher price. Marl is also used in small quantities to color green glass, and in the manufacture of commercial fertilizers.

PAPERS READ BEFORE THE AMERICAN STREET RAILWAY ASSOCIATION.

We gave in our last issue the substance of the reports and papers presented at the Atlanta Convention of the American Street Railway Association, which were of chief interest to our readers. The following are brief abstracts of other papers read at the meeting, and some notes of the discussions will be found included in our report of the proceedings on another page:

The Use of the Booster on Electric Railway Circuits.—By J. H. Vail and S. H. Wynkoop.

The question of investment in copper is one which has always been a bugbear to the street railway manager, and is to-day the most serious problem confronting the operating company, inasmuch as it tends to restrict the extension of long-distance lines for serving suburban traffic. Since the cost of copper for a given service increases directly as the square of the distance, the necessary investment becomes prohibitory when the line extends more than three or four miles from the station. In the heart of the city, crowded streets render slow speed imperative; in the suburbs, where a clear track invites to rapid transit, the pressure is low—usually abominably so. In fact, the writers have in mind a city not far from the metropolis, where two motor cars are run upon a single car's time; and they have witnessed the fading out of the electric headlights as the two cars started out together. The reduced voltage was in this case self-evident; and the net horse power secured to move the cars was probably less than half the proportionate amount originally generated in the station. The loss in transmission does not require further demonstration.

Leaving out of this discussion improvement in generating station, car equipment and track, we must look for higher economy to the alteration of our methods of electrical distribution. We are in need of a marked advance over present practice in this direction, and must devise some method of distribution that shall give better and more economical service over a large area, and which shall at the same time enable us to reach out from the power station to distances at present inaccessible.

The alternating current system, which has done so much to develop the distribution of electricity for lighting by incandescence, has not yet reached that stage of perfection in motive power service which will warrant us in admitting its value for railway work at the present time. Another method which might be suggested is one which contemplates the use of motor generators located at intervals along the line and actuated by high-tension currents. Such a system must be automatic under all conditions of load and short circuits, working with cool bearings and not requiring careful attendance. This scheme also requires practical development.

The booster system, invented by Mr. W. S. Barstow, and applied by him with great success to the feeders of constant potential electric lighting plants covering large areas, is worthy of careful investigation, as it promises to offer a practical aid to the economic solution of what may be called the medium long-distance electric railway problem.

With direct feeding we can overcome the loss in transmitting energy only by incurring the heavy cost of copper as a first investment. With the booster system, we overcome the loss in transmission by incurring the cost of operation of a machine which shall automatically raise the initial voltage above that of the bus bars by an amount which may exactly equal the drop in potential on the feeder at that instant. When using this machine, we calculate our feeder for ampere capacity only, and constantly maintain the pressure at the service end of the feeder equal to the pressure at the bus bars, irrespective of the length of the feeder or the load.

In any given instance, the cost of a direct feeder increases as the square of the distance, while the cost of the booster feeder is directly proportional to the number of miles. These characteristics of the latter system result in a reduction of first cost of from 25 to 75% as compared with the first cost of the ordinary direct feeding methods of our present practice; and it thereby becomes possible for numerous electric street railway companies to extend their lines into suburban localities from 10 to 20 miles distant from the power station, at the same time retaining the investment within reasonable limits. For distances greater than 1½ miles it will cost less to install a booster system than to place copper and machinery in the usual manner for feeding direct.

Ordinarily in calculating copper for distribution, we are obliged to allow for special features influencing traffic, such as ball grounds, race tracks, picnic groves, etc. As there is seldom any necessity for bunching cars at all these points simultaneously, and as the various features are usually scattered, it follows that at all times one or more of the feeders is lying comparatively idle. Under the booster system, the copper is figured for average conditions, and a booster, placed in the station, is arranged to be thrown immediately upon any feeder which may become burdened with an excessive load.

Another feature of this system which results in large economy becomes prominent on long suburban lines forced to run an infrequent schedule late at night. On such a road the booster may be shut down and cut out of circuit entirely when the load on the long-distance feeder drops to, say, one-quarter of the maximum, depending upon the amount of copper in the line. If this suburban line extends to a park or pavilion which is open only during the summer months, the advantage of the booster over direct feeding is enormous, since the investment on a booster lying idle is a small fraction of the interest on the idle copper of a direct feeder.

On many roads already in operation the copper in the line has proved entirely insufficient, and the erection of additional feeders is contemplated. Would it not be worth while to consider the installation of a booster at one-tenth the cost of the extra copper, provided calculations showed the economy of operating the two systems to be equal?

Transfers on Street Railways.—By J. N. Beckley.

The carrying of a passenger from any part of a city, reached by the lines of a street railway, to any other part of such city, reached by the lines of the same railway, for a single fare, is, speaking broadly, a new thing in street railway operation. That a liberal transfer system, properly guarded to prevent fraud, pays, is, I think, now generally recognized. Local conditions and arrangements of lines must be considered in determining the regulations to be adopted. The rules intended to safeguard the company are important. Perhaps equally important is the making of rules broad enough to encourage riding. If a transfer system is adopted, it is best not to hedge it in too much by narrow restrictions or to so complicate its details as to involve labor and expend money unnecessarily.

The tickets should be of liberal size to permit legible type and prevent crowded matter. They should be bound in pads of 100, and the pad be so exactly arranged as to permit punching ten or more in one action of the punch. This feature permits canceling the month and day, and often the time, ten or more at once and accurately, and frequently several of the same destination. It is of great advantage to secure full "month," "days" and "time" space on each ticket—that can be accurately and quickly punched, and it forestalls the waste, expense and detail consequent upon daily dated tickets, while it gives equal protection without delay anywhere.

A "series number" or "conductor's number" or some such designations, on each ticket, will identify the issuer perfectly, and the consecutive number will trace the issue, hold it to sequence in use, and prevent tampering and fraud. We have some 200 conductors. Each has a stock of 25,000 tickets to begin with, renewed as used. Our transfer department has 250 compartments on the wall of the room to hold these tickets (thus providing for increase in conductors), each of 25,000 capacity, so they are all systematically arranged in simple order, one compartment for the tickets of each conductor. The conductor turns in his unused transfers at the end of the day's work, and they are put in his compartment, and given out again to him on beginning work next day. A simple record book keeps this account; one double page for each conductor covers his transactions for the whole year, and shows at a glance each individual transfer account, for comparison or aggregating statistics.

By beginning the consecutive number of each pad at 0, 100, 200, etc., we save complication in subtracting, as then the consecutive number on the upper remaining ticket instantly shows how many tickets have been removed. The consecutive number is not only useful in counting, but compels proper use of the tickets. In conjunction with the time-table each ticket must show when turned in that it was issued in sequence of number and in sequence of time. No. 6,230, say, is issued at 9:30 a. m. Nos. 6,231 and 6,232 may not be returned at all, but if they are they must show issue in direct sequence of time. If not so, the series number tells us instantly who issued the ticket, and the man is spotted and the wrong exposed, for tickets cannot be abstracted and punched for future use as they will not fall within proper time limit and in proper sequence.

By putting the transfer business into the hands of the conductors, we cater to the convenience of passengers, and we obviate delays in traffic consequent upon stopping cars to transfer. We save the large expense of transfer agents, and, in my judgment, do not increase leakage, for it is as easy for transfer agents to stand in with conductors to defraud the company as it is for conductors to combine with each other. The numerous and continual frauds perpetrated upon transfer agents, by people who get transfers without having paid any fare, are too well understood to require discussion. Our liberal system of transfer has proved a good investment, and our form of ticket is efficient and it protects our interests, while it saves us all former waste and a vast amount of useless labor.

A Standard Form of Street Railway Accounts.—By H. I. Bettis.

In adopting a standard classification as a basis for reports from all roads, we must decide upon the minimum number of accounts into which it can be divided, and yet give all the information that the majority would desire. Each of these accounts must be carefully analyzed, and so closely defined that each particular account shall have at all times the same constituent elements on every road. This much decided, any company wishing any more detail may divide and sub-divide, until there are twice or thrice the number of accounts; but still retaining the distinctive features of each particular group. Were there a more uniform system of reports and accounting, there is no doubt but that the stock and bonds of our street railway properties would find an open market abroad.

The classification presented in 1884 was too elaborate for a small company, many directors and managers not caring for information in such minute detail, even on many of our largest and best equipped roads, there being 70 divisions of the operating expenses, while that now submitted has but 30, and even this might be simplified.

Results are what all want, and it matters but little whether the report is divided into 10 or 100 distinctive classes of receipts and expenditures. The road has earned a certain amount, and a certain percentage of that is irrevocably gone, and the sub-division of accounts could not have saved it. This might seem to be an argument in favor of the abolition of everything but the profit and loss account, but we do not go so far as that; we would advocate that the reports be much simplified, and that the standard be simple and concise enough for the smallest road and the most conservative ideas.

In making tests our managers often require statistics as to mileage made by special gears, brushes, truck wheels, trolley wheels and much other similar information. This is perfectly proper and necessary at times for the good management of the road, but it is a side issue, and is not to be considered in making up our standard forms. Not only should we seek uniformity in our reports, but in our methods as well. For instance, we find from the sample pages of some of the account books sent the committee that it is the custom on some roads, when a bill is paid, to charge it

to the account for which the material was used. On other roads the charge to expense is made when the material is received and by others when it is used. This committee holds that the latter is the only correct method, as when material is purchased or paid for we are simply making an exchange of cash for another form of assets, and there is no expense until the material is used.

There is one other point upon which the committee wishes to touch, and that is the construction and equipment accounts. There is a great temptation for a manager whose road is running down on account of bad times, no travel, poor motors, bad track (all, of course, due to the mismanagement of his precedessor) to steer as many items as possible into the construction and equipment account. The committee might also dwell upon the distinction between the transportation charges and the maintenance charges, which were found to be somewhat confused on many of the reports sent in response to our request.

Should the Association adopt the classification submitted, 40% of the roads would be all right as they stand, and 30% more would need to change but two or three items—principally putting the repairs of the power plant under the same head as repairs of the balance of the equipment, where it undoubtedly belongs; 25% more would but need to arrange their accounts systematically, instead of having them in a jumbled state, as most of them have the charges made to the proper accounts, but not arranged systematically in the reports.

The classification as given here is not subdivided to the extent that some might think desirable, but sufficiently for any practical purposes, as any further division would be purely statistical. There are two principal divisions of expenditures, viz.: 1. Construction and Equipment. 2. Operating Expenses. The latter is divided into four groups: 1, General Operating Expense; 2, Transportation Expense; 3, Maintenance of Way and Buildings; 4, Maintenance of Equipment.

The construction and equipment charges include only expenditures which add to the original value of the property. The first two divisions under the head of Operating Expenses, i. e., "General Operating Expense" and "Transportation Expense," include only such expenditures as are necessary for operating the road, while the other two divisions, viz., "Maintenance of Way and Buildings" and "Maintenance of Equipment," include all expenditures made upon the property itself, necessary to keep it in perfect repair.

These maintenance charges are purely operating expenses, but are essentially different from the first two divisions of the operating expense in that they add materially to the present or future value of the property while the general and transportation charges do not.

The classification, as presented, is especially prepared for electric railways, but can be easily adapted to use on cable, horse and steam roads, in fact, it has been used successfully on a combination of electric, horse and steam roads.

"The Best Method of Treating Accidents." By P. M. Dyer.

It is my purpose to explain in what manner the North and West Chicago street railway companies attend to personal injury cases, commencing with the accident and following the theme to the final disposition of the claim. These two corporations carried 167,000,000 passengers during the year ending Dec. 31, 1893, and upon the claim department devolves the duty of investigating all accidents and the making of settlements, or preparation of the defense, in all claims that spring from this great traffic. One claim department does this work for both roads. The working force consists of a medical staff and a sufficient number of investigators, all under the direction of the chief adjuster, who reports to the general counsel of the two companies. Investigation begins immediately after the accident and continues until there has been secured a full and accurate account of the accident, with reliable information as to the nature and extent of the injuries. Employees notify the claim department of the occurrence of an accident on car or train, giving circumstances of the same, nature of injuries to and residence of the injured, and as far as possible secure the names of the witnesses. When this has been accomplished and the injured one has been placed in the charge of a physician or the police, the car or train may continue its journey. In the mean time a representative of the claim department will proceed with all possible despatch to the scene of the accident. If the injured person has not yet been removed, he must see that conveyance is provided to the hospital or to the home. These companies usually bear the expense of temporary medical care and transportation, without regard to liability, believing such attention is appreciated by the injured and the community at large.

All employees witnessing accidents are requested to make written statements of the circumstances of the same on printed forms provided for that purpose, attaching the names and places of residence of all witnesses. This report must be completed and given to the foreman before the employee finishes his day's duties. These reports are forwarded to the claim department without delay, and when received, circular letters containing printed interrogatories are sent to each witness. If the seriousness of the accident demands it, interviews are had with the witnesses. Demand being made for compensation, it becomes the duty of the chief adjuster to place before the general manager or general counsel all facts within his knowledge bearing on the claim, for a decision as to liability, and the naming of the maximum sum to be paid, if a settlement is deemed advisable, the claimant being promptly informed of the decision. The negotiations preceding a settlement are usually conducted by the chief adjuster on the part of the company. If not successful the negotiation will usually be followed by litigation.

After the commencement of suit all witnesses are again located by the claim department, and thereafter located at stated intervals until the time of the trial, and if possible additional witnesses are found to strengthen the defense. Success in defending suits arising from personal injuries largely depends on the character of the work done during the period of investigation. The officers of these companies believe in the thorough investigation of all accidents, if possible the settlement on a reasonable basis of all valid claims, in vigorously contesting fraudulent demands, and that prompt settlements are for the best interests of their companies.

THE LANCASTER RESERVOIR FAILURE.

We briefly recorded in our last issue the breakage of a recently completed reservoir wall at Lancaster, Pa., and the flow of its contents, some 10,000,000 gallons, over the surrounding lands, fortunately, however, with no loss of life and no serious injury to property. The detailed history of this structure contains matter of considerable interest to engineers.

For some years storage capacity has been insufficient on the Lancaster water-works, and in 1890 engineers were consulted as to the advisability of constructing a reservoir. Mr. Charles B. Brush, M. Am. Soc. C. E., recommended that a reservoir be constructed, and a report adverse to such construction was submitted by Mr. Samuel M. Gray, M. Am. Soc. C. E. In the spring of 1892 both reports were submitted to Mr. Benjamin S. Church, M. Am. Soc. C. E., by Mayor Clark, of Lancaster, and the proposal to construct a reservoir was approved by him.

Soon after this the city council instructed some engineer, whose name is unknown to us, to prepare plans and specifications for the work; and he did so, in co-operation with Mr. Brush. In July, 1892, bids were received for the construction of the reservoir, and Mr. Brush was called in by the city authorities to advise as to the letting of the contract, which was finally awarded to Frescoln & Rooney for $64,000. The work consisted in the building of a 15,000,000-gallon reservoir, with gate-house and connecting supply main, etc., and the contractors agreed to complete "a water-tight reservoir" and to maintain it in good condition for one year following its completion.

At this time Mr. Brush was asked his terms to take entire charge of the work; but the committee, apparently with a zeal for economy, after learning them, did not appoint Mr. Brush, but employed the City Regulator, Mr. Allen O. Herr, as engineer, at a salary of $200 per month for himself and an assistant.

Work proceeded for about a year and then the authorities had to call in Mr. Brush again. It appears that in choosing the location of the reservoir the city fathers had pursued a common penny-wise and pound-foolish policy to which we have had frequent occasion to refer, and few or no borings or test pits had been sunk to determine the character of the material on the reservoir site. When the rock was laid bare, as the excavation progressed, it was found that it was a porous, seamy shale, abounding in cavities and fissures. To what extent the contractors were obliged to make good these defects of the foundation at their own expense was the matter at issue. Mr. Brush decided that the contractors were obliged to fill all seams and holes and other discoverable defects of the foundation, but that to ensure the safety of the work the improvement should extend further, and a 12-in. layer of concrete should be put on over the whole bottom. At this time Mr. Brush was placed in full charge of the work as engineer, and until December, 1893, he had his own inspector continually upon the work. About this time, however, some important political changes took place in the city government. The new administration wished to make a reputation for economy, and Mr. Brush's services and those of his inspector were again dispensed with.

In June of the present year Mr. Brush was again called in, the work being then very near completion, and was consulted upon several points in connection with the work. Following this visit, to guard against any possibility of misinterpreting his verbal instructions, he gave a set of written instructions to Mr. Kitch, the inspector upon the work, covering fully all the points on which the inspector had desired instructions. It now appears that in some way or other Mr. Kitch obtained the idea that the blow-off pipe should be surrounded with brick masonry, instead of with puddle, and ordered the contractor to make this change. The contractor had before this time been censured for not obeying the inspector's instructions, and so the brick lining of the pipe, according to the best accounts, was carried through the puddle wall of the bank.

Filling the reservoir began early this month and on Sunday, Oct. 14, the water was 21 ft. in depth. About 10 p. m. the inspector saw the water begin to gush out from the outer slope, near the blow-off pipe, and in an instant a break 30 ft. in width was made, through which the reservoir rapidly emptied.

After a lengthy investigation, the City Solicitor gave as his opinion that the contractors were responsible for the break and must make it good. He based this opinion on the fact that while the contractor was instructed by the city's inspector to place the brick masonry around the blow-off pipe, such a construction was not in accordance with the specifications, and hence the inspector had no authority to require it, and the contractor was at fault in obeying the inspector.

That this opinion would be sustained by the courts seems very doubtful, in view of all the well-established precedents; the general rule is that a principal is bound by the acts of his agent, so far as that agent does not exceed acts which are within the scope of his duties. While in this case the inspector exceeded his authority, or, more accurately, gave wrong orders through his neglect to carefully study and follow his superior's written instructions, it would be manifestly unjust to compel the contractor to assume the loss which such a mistake caused.

THE AIR-BRAKE PATENT DECISION.

The most important patent decision which has been announced for some time is that of the United States Court of Appeals in the case of the Westinghouse Air-Brake Co. vs. the New York Air-Brake Co. The effect of this decision is to sustain the Westinghouse Company's broad patent on the quick-action triple-valve, which, as will be remembered, made practicable the general introduction of air-brakes for freight train service.

For the benefit of those who wish to follow the litigation in detail, we give below an extract covering the important features of the opinion handed down by Judge Shipman. For the clearer understanding of the decision it may be explained that the Westinghouse Co. sued the New York Co. for infringement of three patents on triple-valves, Nos. 376,837 and 448,827, issued to Geo. Westinghouse, and No. 393,784, issued to Harvey S. Park, and owned by the Westinghouse Co. In the trial of these cases before the U. S. Circuit Court, Judge Townsend held that infringement was proved as to the first two patents, but that the Park patent was only entitled to a narrow construction and was not infringed. The Court of Appeals holds that the Westinghouse patent No. 376,837 was a pioneer patent, and as such was entitled to a very broad construction. The subsequent patent to Westinghouse, 448,827, he holds to have been not sufficiently different from the patent already obtained by Westinghouse to constitute a patentable invention. To quote from the decision: "It was simply what the patentee first deemed it to be, a form of the invention of that patent and covered by it. The decision of Judge Townsend with reference to the other subordinate patent, the Park patent, is approved."

Besides the triple-valve patents, the suits covered

infringement of Westinghouse patent No. 222,803, on an engineer's brake valve. The decision in both courts was in favor of the Westinghouse Co. on this patent. The following is taken from the text of Judge Shipman's decision:

The three claims (referring to patent No. 376,837) which were found to have been infringed, are as follows:

1. In a brake mechanism, the combination of a chamber or casing, having direct connections to a brake cylinder and to a brake pipe, respectively, a valve controlling communication between said connections, and a piston or diaphragm which is independent of and unconnected with a triple-valve piston, and is actuated by pressure from an auxiliary reservoir in direction to impart opening movement to said valve, substantially as set forth.

2. The second claim includes a check or non-return valve controlling communication between said valve and the brake-pipe passage of the chamber, substantially as set forth.

3. In a brake mechanism, the combination, with a triple valve, of a supplemental chamber or casing, having passages leading to a brake cylinder and to a brake pipe, respectively, a supplemental piston operating independently of the triple-valve piston and adapted to impart opening movement to said supplemental valve, and a passage establishing communication between said supplemental piston and an auxiliary reservoir, substantially as set forth.

The vital parts of this mechanism are the supplemental chamber, having direct connections to the brake cylinder and the brake pipe, the valve 41, which controls communication between these connections, the emergency piston 63, independent and unconnected with the triple-valve piston and actuated by pressure from the auxiliary reservoir in a direction to impart opening movement to the valve. To these essential parts, the defendant would add another, the particular means by which, in the specification, the emergency piston is actuated, viz.: the excess stroke of the triple-valve piston which uncovers the port 61 through which the auxiliary reservoir pressure passes. Upon the scope of the invention, the question of infringement depends. The defendant insists that the only invention "resides in the use of an emergency piston, which is open to the exhaust port on one side and to the brake cylinder on the other side, and which is not subject to operative pressure from the reservoir, except by the extreme stroke of the triple-valve piston." The assignments of error are confined to this question and the consequent construction of the first three claims and to the question of infringement.

The defendant's theory mistakes the character and scope of the invention, which was another and successful way to accomplish the work designed to be accomplished by No. 360,070, and to be effected, upon the same general plan of instantaneous brake-pipe venting, by the new means contained in the supplemental chamber which have been named.

In No. 360,070 the stem of the triple-valve piston directly engaged with the stem of the emergency valve, and consequently its action directly depended upon the movement of the piston. The invention in 376,837 radically departed from this method of actuating the emergency devices, by making a new piston independent of and unconnected with the triple-valve piston. It was to be actuated by auxiliary reservoir pressure, but the particular means by which this pressure was to be permitted to exert itself, whether continuously or only when a port should be opened, do not constitute an essential part of the invention. Means must necessarily be shown in the specifications, but the identical means or the special devices were not, in the language of Morley Machine Co. vs. Lancaster, 129 U. S. 263, "necessary constituents" of the invention, either in the specification or in the claim. The skill and mechanical ingenuity of constructors of locomotives can, as will be seen hereafter in the examination of other patents and of the infringing devices, arrange different details of mechanical construction, by means of pistons, valves, ports and springs, which, adopting the supplemental chamber system, first conceived and embodied by the patentee, and a kindred, but not precisely the same, mechanical method for the movement of the piston, will accomplish the same result. The patentee was a pioneer in that he designed, in No. 376,837, a new way to accomplish a desired result, but upon the same general idea which he had unsuccessfully tried to work out in the earlier patent. His later patent was the bridge, and not a mere step, which carried railroad car builders from failure to success. It is not important now to determine the grade of its pioneership and whether it may be classed in the list of those inventions which are of the highest rank, but it was an invention created to achieve great necessities and overcome great hindrances, and was one of wide breadth. A court would not be justified in adopting "a narrow or astute construction" which should minimize the character of the invention, leave its real scope open to trespassers and thus "be fatal to the grant." The claims of the patentee do not contract the grant to narrower limits than those which the invention, as made by the patentee, actually covered, and the claims therefore are not limited to the precise mechanical means described in the specification, by which the supplementary piston is actuated. They compel it to be disconnected with and to be independent of a triple-valve piston, and to be actuated by pressure from an auxiliary reservoir by some means equivalent to the means which are described in the specification. The rule which permits, and indeed compels, courts to give a wide range to the equivalents which a broad or pioneer patent can include, is thus expressed in Miller vs. Eagle Mfg. Co., 151 U. S. 186:

If the invention is broad or primary in its character, the range of equivalents will be correspondingly broad, under the liberal construction which the courts give to such inventions.

The defendant uses two forms of devices, known respectively in the case as "Defendant's Quick-Action Triple Valve," and "Defendant's Modified Quick-Action Triple Valve." Each has the supplementary chamber with its contents and in each the various elements conform to the general phraseology of the claims; but in neither does the movement of an emergency piston have any relation to the extreme movement of the triple valve piston; and herein is contained what is claimed to be the essential difference between the patented device and the defendant's valves. In the defendant's "Modified Valve" the pressure upon opposite sides of the emergency piston numbered 13, which correspond in function with emergency piston 63 of the patent, is always counterbalanced when quick action is not desired, whereas emergency piston 63 of the Westinghouse valve is not subjected to auxiliary pressure until its action is required, when port 61 is uncovered.

In the defendant's modified valve, train-pipe pressure is reduced when quick action is wanted, the auxiliary reservoir pressure becomes controlling, forces down emergency valve 20, which corresponds in function with the Westinghouse emergency valve 41, and which, when unseated, opens direct communication between the train pipe and the brake cylinder. This difference between the means which are used to actuate the pistons is not of a patentable importance. The operative features of the invention which are described in the three claims are the same, whether auxiliary pressure is permitted to exert itself continuously or intermittently when a port is opened.

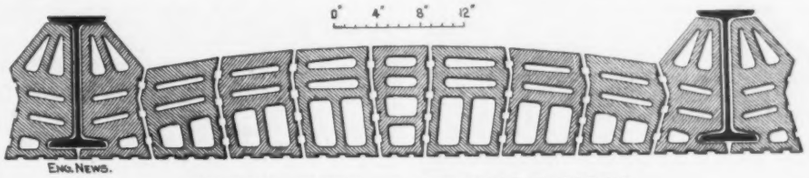
The defendant's earlier device uses two pistons. The first, No. 13, is forced down by auxiliary reservoir pressure, but does not act directly upon the emergency valve. When forced down, "it opens a port, whereby train pressure is admitted to the upper side of the other piston (No. 17), which, being thereby forced down, imparts opening movement to an emergency valve leading to the brake cylinder."

It is true that piston 13, which is the one actuated by auxiliary reservoir pressure, does not directly and of itself impart opening movement to the emergency valve, but uncovers a port which admits train-pipe pressure to the brake cylinder, and it is true that piston No. 17 is actuated by the train-pipe pressure thus admitted. These two pistons do the work of the one piston of the defendant's modified valve. Auxiliary reservoir pressure moves the piston, which, through the intervention of piston 17, imparts opening movement to the emergency valve. Mr. Massey states the difference between the two valves of the defendant to be that in the "quick-action triple-valve" the initially operating piston 13 actuates the emergency valve indirectly; that is to say, through the intermediation of the piston 17, while, in the other valve, the initially operating piston 13 actuates the emergency valve directly, as in patent 376,837. This is not a material difference of a patentable character, when considered with reference to this patent, and the result is that each of the defendant's valves is an infringement. The "quick-action valve" infringes the first three claims, while the second form, not having the additional check valve of the second claim, infringes the first and third claims.

The remainder of the decision, relating to patents 448,827 and 393,784, we omit, as so long as the Westinghouse Co.'s broad patent has been sustained by the court of last resort, it is really immaterial what disposition was made of the subordinate patents, and the substance of the decision respecting them has been given above. In accordance with this decision, the Court of Appeals has sustained the injunction granted a year ago by Judge Townsend restraining the New York Co. from selling or disposing of its infringing devices, and the order for an accounting for damages is also enforced. We commented editorially on this important patent litigation in our issue of Nov. 23, 1893, and have discussed it further in our editorial columns in this issue.

NEW SYSTEM OF FIREPROOF FLOORING.

The accompanying illustration represents a new system of hollow-tile construction for floors of buildings, recently patented by Mr. F. Von Emperger, of New York, and styled by him the "Austria" system. It differs from the ordinary style of hollow-tile arches (either the "old style" or "end construction") in that it has bearing webs arranged, not horizontally, but in an approximately arch-like manner, so that the line of resistance and center line of material are all nearly identical. The lower part forms a filling to which to attach a flat ceiling. The arch increases in depth from 3 ins. at the top to 4 ins. at the haunches, according to the increasing moment of strain. It is claimed that all tests thus far made with hollow-tile floors, besides showing a small margin of safety, have shown that the floors break in the haunches. It is also claimed that with a key or groove in the sides of the blocks, as shown in the cut, the arch would bear a considerable load even if sand alone was used, instead of mortar, which, with other floors, would cause the arch to fall by its own weight, the blocks slipping down so that the arch would deflect and the blocks would then fall out. Mr. Emperger considers it a standard rule in arch construction that the joints should not be relied upon for strength. He is also of the opinion that in common hollow-tile floors the blocks, after being cemented together, are changed to a beam and act as such until fracture occurs under loading. The patented arrangement allows the dimensions of the arch to be proportioned to the loads for which it is designed, while for the common tile arches neither the building law nor the therory gives any means to determine section of webs and heights of tile, which are used merely at the convenience of the builders. The patent covers also the use of the center tile, or key, giving the vertical opening, as shown in the cut, for the reason that it enables the span to be changed within reasonable limits without changing the other tiles. It is the intention of the patentee to manufacture a sample of this floor and give it a fair test to show how far his claims are correct, and these tests may be made in connection with the series of fireproof floor tests noted in another column.



"AUSTRIA" SYSTEM OF FIREPROOF FLOORING.

National aid in building the Nicaragua Canal is strongly advocated by Admiral Daniel Ammen, U. S. N., in a letter just published by him. Admiral Ammen is thoroughly familiar with the route and in this letter points out its advantages over competing projects. He lays particular stress upon the necessity for such a canal in sending cotton to Japan and China and in bringing the products of our Pacific coast to Europe, and in ultimately building up an immense population on that coast. He wants the canal to be made a party issue in the present campaign.

Steel rails are to go still lower in price, according to Pittsburg despatches. The rail combination's figures are $24 per ton, and this price is pretty well maintained in the East; but circumstances are forcing lower figures for the Western and Southern country. The Colorado Iron & Coal Co., with a comparatively small rail mill at Pueblo, lately successfully bid against the Carnegie Steel Co. for 15,000 tons of steel rails, to be used by the Choctaw Coal & Railroad Co., in the Indian Territory. According to the accounts, the Carnegie Co. bid $28.70 per ton, delivered at Oklahoma City. As the freight rate from Pittsburg to this point was quoted to the company at $6.90 per ton, they actually sold the rails for $21.80 per ton. The prospect of the new Youngstown mill undertaking the making of rails may still further affect the price.

CONSTRUCTION NEWS.

RAILWAYS.

East of Chicago—Existing Roads.

BEAVER MEADOW, TRESKOW & NEW BOSTON.—This railway has been opened for traffic from its connection with the Central R. R. of New Jersey, near Beaver Meadow, Pa., to Tamanend, Pa., a distance of about 15 miles.

BUFFALO, ATTICA & ARCADE.—Incorporated in New York to construct a railway from Attica to Freedom, a distance of 30 miles; capital stock, $360,000; directors: Spencer S. Bullis, Olean; Geo. W. Conklin, Attica; Clinton V. Merrick, Bradford, Pa.; Orrin P. Stockwell, Joseph A. Smith, Edward C. Hersch, all of Attica, and others. This company is a reorganization of the Attica & Freedom which is now being rebuilt by S. S. Bullis, Olean, N. Y.

CANADA ATLANTIC.—It is stated that work is rapidly nearing completion on the Ottawa, Arnprior & Parry Sound Ry. The contract calls for the finishing of the grading to Long Lake by Nov. 1, and it is expected that even should disagreeable weather interfere the first week of next month will see the grading done to that place, which is 144 miles west from the Elgin St. station in Ottawa. The tracklaying will be completed by the middle of November. The road is now in operation from Ottawa to Eganville, 75 miles. Ch. Engr., G. A. Mountain, Ottawa.

CENTRAL R. R. OF NEW JERSEY.—Murtagh & Monroe, Wilmington, Del., are reported to have received a contract for building a 3-mile extension of this railway on the New York & Newark division.

CLEARFIELD, CONEMAUGH & WESTERN.—Samuel Brugger, Ch. Engr., is reported as surveying for two spurs, one of 1¼ miles up Pine Run to the coke ovens, and another of about 3 miles along Alexander Run to Ramey, Pa., and connection with the Altoona & Phillipsburg Connection. It is stated that the contract for the construction of the first 33 miles, beginning near Porters', will be let in a few days. Pres., S. J. M. McConnell, Harrisburg, Pa.

DELAWARE & HUDSON.—A contract has been awarded to Callanan Bros. and M. J. Nugent, Keeseville, N. Y., according to reports, for the completion, within 40 days, of a 3-mile extension from Rogers station to pulp mills at Au Sable Forks, N. Y.

FORT PLAIN & RICHFIELD SPRINGS.—The grading of this new railway is reported as fast approaching completion. The line extends from Fort Plain, on the New York Central, to Richfield Springs, N. Y., on the Delaware, Lackawanna & Western, and it is rumored that it will be extended to Oneonta.

FREDERIC & CHARLEVOIX.—Tracklaying on this railway, noted Oct. 4, has reached Alba, Mich., on the Grand Rapids & Indiana, 25 miles from Frederick, on the Michigan Central. The road is standard gage and is laid with 60-lb. steel rails. The ballasting will probably not be completed until next season. It is stated that the grading is completed for 10 miles west of Alba.

PENNSYLVANIA MIDLAND.—The grading has been completed on this railway from Cesana to Brooks Mills, Pa., 23 miles, and the track is now being laid.

PITTSBURG, AKRON & WESTERN.—A press report from Akron, O., states that F. T. Baker, Pres. First National Bank of New York, has purchased this railway for $844,000, and that the unfinished part of the road from that city to New Castle will be completed as soon as possible.

ST. CROIX & PENOBSCOT.—T. R. Atkinson, Bangor, Me., is reported to have been engaged as chief engineer of the proposed extension from Princeton, Me., to a connection with the Maine Central, as noted Oct. 11, and for which the surveys will be commenced this month.

WASHINGTON & CHESAPEAKE BEACH.—It is reported that J. E. Searles, Secy. American Sugar Trust, is negotiating for the control of this incompleted railway. Mr. Searles is the head of a syndicate that has recently effected the consolidation of the Baltimore & East Shore R. R. and the Maryland, Choptank & Eastern Shore Steamboat companies, according to press reports.

WISCASSET & QUEBEC.—At the meeting of the stockholders noted last week it was unanimously voted to authorize an issue of $300,000 of bonds for the purpose of completing and extending the road to a connection with the Canadian Pacific. The road will be finished to Burnham, Me., the present season.

WISCONSIN & MICHIGAN.—This railway has been opened for traffic. It extends from a connection with the Soo Line in Michigan to Peshtigo, Wis., and about six miles of track remain to be laid on the north end. It is reported that next season the road will be extended northwest to Norway, 12 miles, and thence to Iron Mountain, Mich., about 8 miles further. The car shops are to be located at Peshtigo, Wis. Pres., Samuel Fisher, Chicago; Treas. and Secy., J. N. Faithorn, Chicago; Gen. Man., John Bagley, Marinette, Wis.; Supt., J. E. Williams, Menominee, Mich.

Projects and Surveys.

BRADY'S BEND & BUTLER.—It is reported that the construction of this railway will soon be commenced. The final survey has been completed by Richard Rowe, Kaylor, Pa.

WOODSTOCK & CENTREVILLE.—The contract for building this railway from Woodstock, N. B., to the international boundary line, a distance of 26 miles, has been awarded to Killen & Moniger, Boston, the work to be completed by Dec. 1, 1895. Pres., A. P. Mason, of the Globe Investment Co., Boston.

Southern—Existing Roads.

QUINNIMONT COAL CO.—E. S. Whitney, Allentown, Pa., is reported to have contracted to extend the railway of the Quinnimont Coal Co., Quinnimont, W. Va., about four miles.

RICHMOND, PETERSBURG & CAROLINA.—Jas. H. McCreery, Gen. W. G. Dacey and others, of New York, are negotiating with the city of Petersburg, Va., for the purchase of this incompleted railway and the completion of the same between that city and Ridgway, N. C., within 1½ years. The Baltimore "Sun" states that the system of roads it is proposed to build will consist of the Baltimore & Southern, in Maryland; the Baltimore, Richmond & Southern, in Virginia, and the completion of the Richmond, Petersburg & Carolina road to Warren Plains, in North Carolina, a distance of 285 miles. At Warren Plains this proposed trunk line will connect with other Southern roads. The cost of the entire system will be in the neighborhood of $6,000,000.

SOUTHERN.—Press reports from Birmingham, Ala., state that this company has perfected plans for the purchase of the Paducah, Tennessee & Alabama, the Birmingham, Sheffield & Tennessee, and the Mobile & Birmingham railways, and their completion and connection with one another. This would give the Southern a direct line between the gulf at Mobile and St. Louis and make it an active competitor with the Louisville & Nashville; also affording a much desired Western outlet. The completion of the Paducah, Quinnimont & Alabama, between Paducah, Ky., and Florence, Ala., would require 50 miles of additional road, while the Birmingham, Sheffield & Tennessee lacks about 35 miles of being completed.

Projects and Surveys.

OUYLER & WOODBURN.—Incorporated in Georgia Oct. 16 by J. N. Wood, J. L. Hogan and others of Bullock county, and J. L. Fleming and F. T. Lockhart, of Richmond county. It is stated that the rails have been purchased and are to be delivered at Cuyler, Ga., Nov. 1.

GAINESVILLE.—It is reported that final surveys have been made for a standard gage dummy line from Gainesville, A.a., to Epes, and that the contracts for the construction will soon be awarded.

NEW ROADS.—A press report from Raleigh, N. C., states that applications will be made for charters at the coming session of the legislature of that state for the Saluda Valley R. R., which is to extend from Earley to Greenwood, by way of Piedmont and Feltzer; another will run from Piedmont to Abbeville Court House, by way of Feltzer, Belton and Williamston, and a third, which will be called the Chester & Greenville, will be 69 miles in length, and will extend from Chester to Greenville. A new branch line is being built in Virginia, which will connect the Mountain Lake iron and timber lands, in Giles county, recently bought by a syndicate of Northern capitalists, with the Norfolk & Western at a station called Curve, in Giles county.

PADUCAH, CAIRO & WESTERN.—N. R. Olcott, Ch. Engr., Paducah, Ky., writes us as follows: On Oct. 15 the city of Paducah, Ky., granted this railway the right of way to construct its road through the city along the Ohio River front, giving the company independent connections with all railways at present entering the city and with all steamboat landings. The route has been surveyed and will probably be put under construction at an early date. This line is the most important at present contemplated in the Mississippi Valley. It connects the cities of Paducah and Cairo, Ill., and the several trunk lines at each. Pres., W. J. Hills; Vice-Pres., Geo. O. Hart; Secy., A. J. Welch; principal office, Paducah, Ky.

SOUTHPORT & CONWAY.—M. Fergusson, Southport, N. C., has just completed the reconnaissance for a proposed railway between Southport, N. C., and Conway, S. C.

Northwest—Existing Roads.

DULUTH, MISSABE & NORTHERN.—A press report from Virginia, Minn., states that this company will put a large force of men at work at once constructing a line from Iron Junction to the new town of Eveleth, a distance of about 10 miles. This will give Eveleth two railways, as the Duluth & Iron Range has already built in there.

Southwest—Existing Roads.

TEXAS CENTRAL.—Press reports state that a branch of this railway will soon be built to Thurber, Erath county, Tex., the center of the northwest coal mining region. The road will be built by H. N. Smith, Jr., who is reported as owning large tracts of land in that vicinity.

Projects and Surveys.

CORSICANA, TEX.—R. H. Downey & Co., Houston, Tex., who have the contract for building this railway from Corsicana to Fairfield, Tex., are reported as to begin the work Nov. 1 and have the railway completed by April 1, 1895. Pres., C. W. Coykendall, Corsicana, Tex.

Rocky Mt. and Pacific—Existing Roads.

MOHAWK VALLEY.—This road was noted in our issue of Oct. 11. It is now stated that W. H. Knox has been awarded the contract for repairing the 15 miles already built and for constructing 9 miles of new road through the Sierra Valley.

Projects and Surveys.

BRITISH COLUMBIA.—D. D. Mann, of Montreal, has just returned from the investigation of a route for a railway from the main line of the Canadian Pacific to Barkerville, 280 miles, in the heart of the Cariboo gold mining district in British Columbia. The route is very mountainous, but it is thought that the road can be built in three years, and that the construction will be commenced next spring.

COLORADO WESTERN.—Incorporated in Colorado to build a railway from Grand Junction, Colo., to Provo, Utah; capital stock, $1,000,000; incorporators, St. Vrain Le Sieur, Provo, Utah; S. M. Logan, W. G. Bristol, H. W. Ross, L. G. McMullen, Grand Junction, Colo. The company will also operate asphaltum mines.

LOS ANGELES, SAN FRANCISCO & SALT LAKE.—Incorporated in California to build a railway from Los Angeles to Salt Lake City, Utah; capital stock, $12,000,000; Pres., John M. C. Marble, Pres. National Bank of California; Vice-Pres., T. B. Barnett, Treas. Los Angeles Terminal Ry. Co.; Jefferson Chandler and Shirley Ward, lawyers, Los Angeles; Arthur Young, representing the English syndicate that purchased the property of the Bear Valley Irrigation Co., San Bernardino, as noted last week, is named as secretary and treasurer; C. C. Q. Stuart, Chicago, and C. W. Rogers, Los Angeles, are also directors. It is stated that construction will soon be in progress at both Los Angeles and Salt Lake City.

STREET AND ELECTRIC RAILWAYS.

BRAINTREE, MASS.—The Weymouth & Braintree St. Ry. Co. has obtained a franchise to build a line from Weymouth Centre to the N. Y., N. H. & H. R. R. station this city, and will begin the construction this month, according to reports.

EAST WAREHAM, MASS.—The East Wareham, Onset Bay & Point Independence St. Ry. Co. has appointed a committee to investigate electricity as motive power for the road. Pres., T. B. Griffith; Treas., I. B. Eldridge.

FALL RIVER, MASS.—F. S. Stevens, R. T. Davis, C. F. Shaw and others will petition the legislature for a charter for the Fall River & Providence St. Ry. Co., with a capital stock of $100,000, to construct an electric railway.

GLOUCESTER, MASS.—The Gloucester & Beverly St. Ry. Co., Pres., W. B. Ferguson, and the Gloucester & Rockport St. Ry. Co. have petitioned for franchises for important electric railway extensions.

HINGHAM, MASS.—A company has been formed and applied for a franchise for 18 miles of electric railway. The main line will be between Weymouth and Nantucket, a distance of five miles.

LOWELL, MASS.—The Lowell & Suburban and the Lowell, Lawrence & Haverhill St. R. R. companies have been granted franchises to extend their lines in this city. The latter company is to build a 50-ft. street about 1,200 ft. long.

MARLBORO, MASS.—The Marlboro & Westboro St. Ry. Co. has been organized with a capital stock of $100,000. It is proposed to construct a line from this city to Westboro, by way of Southboro, a distance of seven miles. Directors, J. O. Burdett, Hingham; A. M. Bridgman, Stoughton; L. V. Price, Brockton; E. C. Bates, Westboro; W. E. Blake, Marlboro.

QUINCY, MASS.—The Quincy & Boston Ry. Co. is considering an extension of its electric line from South Quincy to connect with the Braintree St. Ry., a distance of one mile.

SOUTH WEYMOUTH, MASS.—The Abington & Rockland Ry. Co. has been granted a franchise to extend its electric line to connect with East Weymouth, a distance of three miles.

PROVIDENCE, R. I.—The Providence Cable Tramway Co. has obtained permission to construct an electric railway over College Hill.

NORWALK, CONN.—The selectmen have granted a franchise to the Tramway Co. to extend its line to Darlon's Point, estimated to cost $30,000.

BINGHAMTON, N. Y.—The Binghamton, Lestershire & Union R. R. Co. has been incorporated to construct a street railway six miles in length; capital stock, $100,000; directors, J. B. Landfield, J. P. E. Clark, J. B. Rogers, F. E. Ross.

NEWTOWN, N. Y.—The Brooklyn, Newtown & Bowery Bay Ry. Co. has been incorporated with a capital stock of $100,000, to construct a railway 6½ miles long; directors, S. F. Worthington, A. D. Hance, Winfield; A. C. Combes, P. V. P. Mundy, Newtown; F. W. Meinikheim, Maspeth.

NIAGARA FALLS, N. Y.—The company incorporated several weeks ago to construct a double-track electric railway on the American side of the Niagara River from this city to Lewiston has nearly finished securing the right of way. W. Aryl Ely, of this city, is securing the right of way for a similar road between this place and Tonawanda. If this is secured connections will be made with the line now running between Buffalo and Tonawanda, giving a complete connection between Buffalo and Lewiston. The road will run alongside of the river most of the way and will afford fine opportunities for sightseeing.

OGDENSBURG, N. Y.—The Ogdensburg St. Ry. is to be rebuilt and equipped with electricity and extended to the state hospital. The improvements are estimated to cost about $125,000.

CLARKESBORO, N. J.—The citizens of this place and the adjacent towns are making efforts to organize a company and to build an electric railway from Swedesboro to Woodbury and from Mullica Hill to the Delaware River, taking in the towns of Mullica Hill and Paulsboro. A meeting has been held and a temporary organization effected by the election of J. S. Somers, of this place, as president, and J. J. Davidson, Swedesboro, as secretary.

GIRARDVILLE, PA.—The Williams Valley St. Ry. Co. has been incorporated to construct an electric railway from Reiner City to Lykens, a distance of 12 miles; capital stock, $100,000; Pres., Philip Porter-Bastner.

NORRISTOWN, PA.—Surveys are being made for the Norristown & Chestnut Hill Electric R. R. The company has agreed to pave from curb to curb to the amount of $20,000. At the expiration of ten years the company is to pave all the remaining streets on its route, one square each year until finished.

POTTSTOWN, PA.—It is reported that bids are being received by the Pottstown Passenger Ry. Co. for extending its line to Bannockburn Mills from Stowe.

WILLIAMSPORT, PA.—The construction of an electric railway from Jersey Shore to this place by way of Nippenose Valley is being discussed. J. B. Denworth, Williamsport; Levi Gann, Lock Haven, and John Engler, Nippenose Valley, have been appointed to make surveys.

JACKSON, TENN.—The street railway company has been reorganized and will equip its line with electricity. Pres., J. H. Hunter; Secy., J. W. N. Burkett; Treas., J. L. Wisdom.

EMINENCE, KY.—The "Constitutionalist" has revived a project for an electric railway between this place and New Castle.

AKRON, O.—Franchises were granted Oct. 15 by the county commissioners to the Selberling Co., the Akron, Bedford & Cleveland R. R. Co. and to the Cleveland-Akron Electric Ry. Co. for electric lines to Cleveland. They will follow separate routes. The Selberling Co. is now getting right of way.

BEREA, O.—The Cleveland & Berea St. Ry. Co. has obtained a franchise for an electric railway to connect Elyria with Cleveland. L. M. Coe is interested.

FINDLAY, O.—Right of way is being secured for an electric railway to connect Findlay, Bowling Green and Toledo. G. R. Kerper, Cincinnati, Pres. Findlay St. Ry. Co., and E. H. McKnight, Bowling Green, are interested.

MISHAWAKA, IND.—The council has voted to grant a franchise to J. McM. Smith, South Bend, for an electric railway.

BAY CITY, MICH.—W. S. Eddy, Saginaw; W. Y.

Soper and Thomas Ahearn, Ottawa, Ont., have applied to the council for a franchise for an electric railway from 23d St. to North Ave. It is proposed to extend the Saginaw & Bay City St. Ry. a distance of 10 miles.

JOLIET, ILL.—It is reported that R. B. Campbell, Gen. Man. B. & O. R. R.; J. W. Fortune, Asst. Man. Grand Trunk R. R., and A. J. Green, Windsor, Ont., are negotiating for the purchase of the Joliet St. Ry. and the plants of the Economy Light & Power Co and Joliet Gas Works, and that it is proposed to extend the railway from Lockport to Chicago and have the line equipped with electricity.

STEVENS POINT, WIS.—The Stevens Point Electric Lighting Co. has been granted a franchise for an electric railway.

INDEPENDENCE, KAN.—The Farmers' & Merchants' Suburban R. R. Co. has been incorporated with a capital stock of $200,000; a line will be constructed from Independence to Petroleum Park, with branches to Cherryvale, Coffeyville, Liberty and Neodesha; directors, M. J. Paul, M. F. Wood, Edwin Foster.

FALLS CITY, NEB.—The council has voted to grant a franchise for a street railway.

KANSAS CITY, MO.—The Kansas City Traction Co. has been incorporated with a capital stock of $100,000; incorporators, W. J. Smith, James Lissis and W. H. Lucas.

ST. LOUIS, MO.—The St. Louis & Meramec River Ry. Co. has been granted an extension of six months in which to accept the franchise for the construction of an electric railway from St. Louis to Meramec Heights by way of Kirkwood.

NOTRE DAME DE GRACE, QUE.—The Montreal Park & Island Ry. Co. is discussing the question of extending its electric line to this place and Cote St., Antoine.

QUEBEC, QUE.—The Quebec City & District Ry. Co. has been incorporated to construct an electric railway in this city, and in eight counties, by L. P. Pelletier, P. Landry, B. Leonard.

AYLMER, ONT.—The legislature has been petitioned for a charter for an electric railway in Hull township, Aylmer, Gatineau Point, Ironsides, Chelsea and La Peche; capital stock, $25,000; Theophile Vian, J. P. Demartigny, Hull; Alexander Bougeau, Montreal, are interested.

DUNDAS, ONT.—The council is to submit a bylaw to the citizens asking them to vote $25,000 bonus to the Toronto, Hamilton & Buffalo Ry. Co., to construct its electric railway through this place.

LONDON, ONT.—The city engineer has been preparing estimates of the cost of building and equipping ten miles of electric railway.

HIGHWAYS.

MASSACHUSETTS.—The state highway commissioners, Boston, have decided to construct a road between Fall River and Westport. It is expected to have two miles completed before winter. G. W. Perkins, Chn.; Engr., Charles Mills.——The state highway commissioners have 17 pieces of road under construction and have under consideration about 30 additional sections, a number of which are in Essex county.

NEW JERSEY.—The freeholders of Morris county have been granted permission to issue $350,000 in bonds for constructing macadamized highways. Address Morristown.

COLORADO.—The Book Cliffs Toll Road Co. was incorporated Oct. 12 by C. O. Baxter, St. Louis, and F. D. De Soto, Denver; capital stock, $50,000. The road will be constructed from Crevasse siding on the Rio Grande Western Ry. a few miles west of Grand Junction to the Utah asphaltum beds up near the Book Cliffs, a distance of about 50 miles. The road is to be used for transporting asphalt from these fields for general use.

BRIDGES.

BUFFALO, N. Y.—The board of public works sent a communication to the council Oct. 22 recommending that it be authorized to prepare plans and specifications and advertise for bids for the construction of an iron bridge on Niagara St. over Scajaquada Creek. Estimated cost, $50,000.

NEW ORLEANS, LA.—Bids are asked until Nov. 9 for an iron bridge across the Carondelet Navigation Canal. Chas. R. Kennedy, Cy. Comptroller.

GRAND RAPIDS, MICH.—The Plainfield Ave. Gravel Road Co. has been restrained from collecting any toll on Plainfield Ave. from the city limits to the Canal St. gravel road, unless it takes steps within 60 days to rebuild the bridge across Grand River, washed away in March, 1893.

DENVER, COLO.—The board of public works has decided to advertise for bids for the erection of a new steel through bridge across the South Platte River at 38th St. The plans provide for a two-span bridge of three Pratt trusses, with two 16-ft. roadways and two 8-ft. walks, the whole to be erected on tubular foundations.

WATER-WORKS.

BAR HARBOR, ME.—It is reported that $35,000 will be spent in improving the works this winter.

DANFORTH, ME.—The Danforth Water Co. has been organized with a capital stock of $100,000; Pres., W. B. Moulton; Treas., E. C. Tobey, both of Portland.

UNION, ME.—The Union Water Co. has decided upon a supply and will construct a reservoir this fall, according to reports; mains will be 6 and 4-in., with 2-in. house connections. Pres., F. A. Alden; Secy., B. Burton.

GORHAM, N. H.—The Grand Trunk Ry. Co. is reported as building a 300,000-gallon reservoir on a hill at this place.

BOSTON, MASS.—Bids are asked until Oct. 27 for building an addition to Mystic pumping station, with engine and boiler foundations. E. M. Wheelwright, Cy. Arch.

BROOKFIELD, MASS.—The engineer has reported against sinking additional wells and in favor of a supply from South Pond; estimated cost of pumping station and connections, $50,000, and with $40,000 additional pipes can be laid to West Brookfield and Warren. The question of issuing $90,000 in bonds was referred to next annual town meeting.

EDGARTOWN, MASS.—The town clerk writes us that the citizens are agitating the question of works, but that no other action will probably be taken until the annual meeting in March.

GLOUCESTER, MASS.—The Gloucester Water Supply Co. is reported as about to extend its service to Fernwood, West Gloucester.

LONG MEADOW, MASS.—Wm. B. Medlicott, Town Treas., writes us that C. L. Goodhue has been awarded the contract for works to be owned by the town; 28,000 ft. of mains; Deane steam pump; standpipe 100 ft. high to be furnished by R. F. Hawkins; reservoir to be constructed by T. D. Watters.

NORTON, MASS.—Jacob A. Leonard, Town Clk., writes us that the question of works has not yet come before the town for action.

CANANDAIGUA, N. Y.—M. T. Powell, Clk., writes us that the prospects are favorable for new works complete, for which preliminary surveys are being made.

HIGHLAND, N. Y.—A new 150,000-gallon reservoir is to be built this fall. Address Aaron Rhodes.

NEWTOWN, N. Y.—The Citizens' Water Supply Co. has increased its capital stock from $50,000 to $100,000.

JERSEY CITY, N. J.—The Potable Water Co. was incorporated Oct. 23 with a capital stock of $10,000, by Dr. Orazio Lugo, R. M. McKenzie and John D. Gorman.

HUMMELSTOWN, PA.—The Hummelstown Water Co. is receiving bids for extensions. G. P. Hoffer, Secy.

LIGONIER, PA.—The council is reported about to take steps for works, for which the citizens voted nearly a year ago.

MOUNT HOLLY SPRINGS, PA.—S. P. Goodyear, Secy., writes us that the Mt. Holly Water Co. is putting in works estimated to cost $25,000; gravity supply from springs 3½ miles distant.

RANKIN, PA.—The council has decided not to put in new works as contemplated, but to secure a supply from Braddock or from the Pennsylvania Water Co., of Wilkinsburg.

WERNERSVILLE, PA.—Kay & Coon, Bellwood, Pa., have been awarded the contract for works, at $8,597; construction to be commenced Nov. 1, and completed Jan. 1.

MOUNTAIN LAKE PARK, MD.—Potter & Folwell, New York and Pittsburg, have been engaged to design a system of water-works and an electric light plant.

ABBEVILLE, GA.—J. D. Lawson, Clk. Council, writes us that bonds have been voted, but no other definite steps have been taken.

AUGUSTA, GA.—P. S. North, Cy. Clk., writes us that no contract for the proposed new works will be awarded until next year.——The city has purchased a site for the reservoir for the new works.

COLUMBUS, GA.—N. M. Moore, Clk. Council, writes us that the question of issuing $350,000 in bonds for new works will be voted upon Dec. 8; proposed supply from Roaring Creek, three miles from city; population, 19,303.

DAWSON, GA.—An election will be held Nov. 14 to vote on an issue of $35,000 in bonds for works and an electric light plant.

GREENVILLE, MISS.—J. M. Lee, Cy. Clk., writes us that the city has granted a 20-year franchise; works to include 10 miles of mains and 100 hydrants, at $40 each per year; contract to be submitted to the voters of the city.

ELMWOOD PLACE, O.—An election will be held Nov. 6 to vote on the question of works and electric lights. John Kindel, Clk.

UNION CITY, O.—Bids are asked until Nov. 15 for constructing works, including about 18,000 ft. of 8 to 4-in. mains. Chas. Suma, Clk.

WOOSTER, O.—Jas. B. Beer, Chn. Com., writes us the committee has several sources in view for an additional supply, as noted last week, and that arrangements for the required construction will probably be made after the committee makes a formal report.

CAMBRIDGE CITY, IND.—Bids are asked until Nov. 1 for the purchase of $25,000 of 6% water bonds. C. H. Tabke, Clk.

CONVERSE, IND.—The citizens have voted on an issue of $10,000 in bonds for works.

GREENWOOD, IND.—Works may be put in at a cost of about $7,000.

IRVINGTON, IND.—A committee is reported as investigating the question of works.

VEVAY, IND.—Bids will be asked at once for the construction of works, according to reports.

DETROIT, MICH.—R. D. Wood & Co., Philadelphia, have been awarded a contract for hydrants.

FLUSHING, MICH.—A. E. Ransom, Cy. Clk., writes us that no contracts for works will be let before next spring.

ROCHESTER, MICH.—John F. Jackson, Village Clk., writes us that a gravity system is proposed and that water from various springs is being analyzed and options secured; population, 1,050.

TRENTON, MICH.—C. H. Kimball, Village Clk., writes us that the citizens have voted against works.

UNION CITY, MICH.—The contract for works has been awarded to Whitney & Co., Quincy, at about $20,000, according to press reports.

ALTON, ILL.—The Alton Water Works Co. is reported as arranging to put in a $30,000 filter.

COLFAX, ILL.—Geo. W. Myers, Cy. Clk., writes us nothing will be done before next spring, except digging or boring the well for a supply.

ROSEVILLE, ILL.—Bids are asked until Oct. 31 for constructing works, as stated in our advertising columns. Consult Engr., Chas. F. Sturtevant, St. Louis.

ROSSVILLE, ILL.—Bids are asked until Nov. 10 for constructing works. S. W. McGuire, Village Clk., writes us that all the bids recently received were rejected, and new bids are asked according to the same plans and specifications.

TURNER, ILL.—D. C. Ahern, Village Clk., writes us that an election will be held Nov. 13 to vote on the question of works.

GALESVILLE, WIS.—Press reports state that G. L. Heuston, Asst. Cy. Engr., Winona, Minn., is engaged in making plans for works.

JANESVILLE, WIS.—The council is trying to have the franchise of the water company declared forfeited. The city wishes to purchase the works, but the company asks $460,000, which is considered exorbitant.

KENOSHA, WIS.—The City Water Co. has been incorporated with a capital stock of $5,000, by Peter Rhode, John Gershon and Burr Simmons.

SPARTA, WIS.—An election will be held Nov. 6 to vote on an issue of $22,000 in bonds for constructing works.

WAUWATOSA, WIS.—It is stated that Grey Bros. will secure an artesian supply, instead of the proposed supply from the Milwaukee mains.

AKRON, IA.—Bids are asked until Oct. 25 for the purchase of $4,100 in 10-year 6% water bonds. G. E. Wells, Recdr., writes us that the contract for works has been awarded to the Smedley Mfg. Co., Dubuque, at $5,788; population, 940.

CASCADE, IA.—The citizens have voted in favor of works.

DAYTON, IA.—G. T. Bygel, Recdr., writes us that the contract for works has been awarded to the U. S. Wind Engine & Pump Co., Batavia, Ill.; bonds sold to W. W. Harris & Co., Chicago; Engr., F. S. Hoyt, Fort Dodge; population, 1,000.

DUNLAP, IA.—The citizens have voted to issue bonds for works. Thos. Roche, Recdr., writes us that no plans have yet been prepared.

FOREST CITY, IA.—J. A. Peters, Cy. Recdr., writes us that bonds have been voted for works, which will include a stand-pipe, but no contract has yet been awarded; construction will be commenced this fall or early next spring.

HULL, IA.—N. G. O. Coad, Mayor, writes us that nothing will be done for works before next year; supply from deep well; population, 1,000.

OTTUMWA, IA.—The Ottumwa Artesian Water Co. is preparing to make $5,000 worth of extensions, according to local papers, and may add a filter plant.

ROCKWELL CITY, IA.—Geo. W. Spencer, Cy. Clk., writes us that the water-works proposition was defeated by one vote and that the question may be submitted again soon.

SPIRIT LAKE, IA.—Geo. S. Tuttle, Recdr., writes us that the contract for works, as noted last week, has been awarded to the Smedley Mfg. Co., Dubuque; supply from well; population, 1,100.

FULDA, MINN.—Robt. Hyslop, Recdr., writes us that the contract for proposed extensions has been awarded to Tobin, Gleason & Smith, of Minneapolis, Engrs., Pike & Soublett, Minneapolis.

LONG PRAIRIE, MINN.—Bids are asked until Nov. 1 for the construction of works, as noted last week, and until Nov. 7 for the purchase of $10,000 of 6% water bonds. Jos. Deuhs, Recdr.

PRESTON, MINN.—About a month ago the citizens voted for works, but at an election Oct. 11 the question was again voted upon and defeated by a small majority. M. R. Todd, Mayor.

ST. CLOUD, MINN.—Plans are being considered for an extension of the mains to the reformatory, a distance of two miles, estimated to cost $10,000.

WELLS, MINN.—Bids are asked until Oct. 29 for the construction of works, including pumping plant, water-tower and masonry reservoir. Engr., Chas. F. Loweth, St. Paul. A. O. Oleson, Village Recdr.

SENECA, KAN.—A press report states that this place has had another large fire and there is more talk of water-works.

AUBURN, NEB.—The $20,000 of water bonds have been sold and the construction of works will be commenced at once, according to reports.

HUMBOLDT, NEB.—The following bids were received Oct. 12 for constructing works: Fremont Foundry & Machine Co., $14,600; Pomerene & Cooper, Lincoln, $14,613; Franklin Electric Co., Kansas City, $16,400; John Gilligan, Humboldt, $14,485; Daniel Spicer, Humboldt, $13,824 (awarded contract).

TALMAGE, NEB.—Bids are asked until Nov. 8 for constructing works. The citizens have voted to issue $8,000 in bonds for works. Engr., A. A. Richardson, Lincoln, Neb.

CARTHAGE, MO.—The Carthage Water-Works Co. is reported to have contracted for a Tripoli filter to filter the entire supply.

ST. CHARLES, MO.—Bids are asked until Nov. 9 for a steel stand-pipe, etc., as stated in our advertising columns. Consult. Engr., Edward Flad, Laclede Bldg., St. Louis. H. C. Scott, Pres. W. Co.

FAYETTEVILLE, ARK.—The council has accepted a proposition of a Joplin, Mo., firm to put in works, the city to pay $2,000 annually for 44 hydrants. The supply will be taken from White River, 2¼ miles southeast of the town, and will be filtered.

LITTLE ROCK, ARK.—Bids are asked until Oct. 30 for constructing works at the new military fort near this city. Capt. Robt. R. Stevens, A. Q. M., U. S. A.

BRENHAM, TEX.—A committee has been appointed to negotiate with a new company for works.

CAMERON, TEX.—Frank Hooks, Cy. Secy., writes us that the plant of the Cameron Water Power & Electric Co., for which bids are now asked, as noted in our issues of Oct. 11 and 18, will include a dam in the river, with power wheel and engine for use in times of high water, bids to be opened Nov. 1. The city is in partnership with the company. Engr., M. P. Kelly; population, 3,500.

DALLAS, TEX.—R. W. Havens, Cy. Engr., writes us that the contract for constructing dams, engine pits, etc., has been awarded to Brownlee & Waespi, Dallas, at $22,692. The itemized bids were published last week under Contract Prices.

HILLSBORO, TEX.—Geo. R. Terrell, Cy. Secy., writes us that D. A. Poyner is preparing plans for works; supply from artesian well; population, 5,000.

McKINNEY, TEX.—R. F. Dowell, Cy. Secy., writes us that the city contemplates putting in works. The city now has a supply of artesian water which does not flow out of the ground.

TRINITY, TEX.—There is talk of constructing works.

FORT RENO, OKLA.—Bids are asked until Nov. 7 for a boiler and pump house, and also for a new water supply system at Fort Reno. Address the Post Quartermaster at this place, or J. D. Bingham, Asst. Q. M. G., Chicago, Ill.

GRAND JUNCTION, COLO.—The citizens are reported as discussing a proposition for works.

ASTORIA, ORE.—Adams & Gemmell, Salt Lake City, Utah, and Pendleton, Ore., have completed plans for new works at this place, for the construction of which bids will probably be asked as soon as the necessary bonds are sold. The work will include 11½ miles of 18-in. gravity conduit through a rough and timbered country, a 6,000,000-gallon reservoir, a tunnel 1,200 ft. in length, and a distributing system. All parts of the city, ranging in elevation from tidewater to 550 ft. above it, will be supplied by gravity or by pumps operated by the gravity pressure. An aerating fountain 75 ft. in height and discharging at the rate of 2,800 gallons per minute is a feature of the work. Estimated cost, $200,000.

FOREST GROVE, ORE.—The city is reported as offered works for $10,500.

LOS ANGELES, CAL.—The Bouton Water Co. has been incorporated with a capital stock of $100,000, of which one-half is subscribed, to acquire water rights and construct works; incorporators, E. Bouton, F. B. Burnett, Wm. Wincup and Fred K. Rule, Los Angeles, and Thos. Stovell, Long Beach.

OROVILLE, CAL.—A franchise for works has been granted to the Oroville Water Co.

SANTA ROSA, CAL.—C. L. Mobley, Cy. Clk., writes us that the contract for works has been awarded to Robt. Effey, Santa Cruz, at $161,000, work to include a 1,000,000-gallon duplex pump, 500,000-gallon reservoir and 25 miles of 14 to 2-in. cast iron pipe. Engr., C. Monjeau, Cincinnati, O.

BALLARD, WASH.—E. O. Marsh, Cy. Clk., writes us that the bonds voted for works have not yet been sold and consequently no contracts have yet been awarded; supply from artesian wells; population, 2,500. S. K. Smith, Cy. Engr.

CHATHAM, ONT.—The city is talking of purchasing the works.

SUDBURY, ONT.—Bids are asked until Nov. 1 for plans and specifications for a complete system of waterworks, sewers and electric lights. R. T. MacEwan, Chn. Com.

PICTOU, N. S.—The citizens are reported as making an effort to secure works.

ARTESIAN WELLS.

WICHITA, KAN.—Bids are asked until Nov. 12 for drilling two prospect wells 2,000 ft. deep, contractor to furnish all machinery and material. H. L. Jackson, Cy. Engr.

OMAHA, NEB.—The park board has awarded a contract for an artesian well 1,800 ft. deep in Riverview Park to J. A. Beverly, at $3.50 per ft.

GAINESVILLE, TEX.—The council has contracted with H. McGilloray to bore the proposed artesian well.

IRRIGATION.

AINSWORTH, NEB.—A press report states that Geo. Campen, Asst. Cy. Engr., Lincoln, with eight others left here for the headwaters of a proposed irrigation ditch on Snake River, and before returning will make a permanent survey for the entire main ditch. The county has made an appropriation to pay for the permanent survey, and as soon as this is done and cost estimated there is no doubt that bonds will be voted to construct the entire ditch.

BURWELL, NEB.—The citizens voted Oct. 17 to issue bonds for a ditch to irrigate 20,000 acres.

NELIGH, NEB.—A committee has been appointed to investigate the advisability of issuing bonds to aid the Neligh Irrigation & Water Power Co., noted Oct. 11, which proposes to construct a canal north of the Elkhorn River from Clearwater to this place for irrigation and water power purposes.

COLORADO, TEX.—Surveys are being made of the river valley north of this place with a view to building a large dam for irrigating purposes.

NEW COMPANIES.—San Dimas Irrigation Co., San Dimas, Cal.; $160,000; J. W. Walker, J. A. Johnston, A. B. Smith, of San Dimas, and H. G. Billings and J. R. Taberman, of Los Angeles.——South Side Irrigation & Land Co., North Platte, Neb.; $75,000: C. E. Osgood, Fredrick Kade, Claus Mylander, G. F. Meyer.

SEWERS.

BROOKLYN, N. Y.—The bids received Oct. 12 for constructing three sewers in Ward 26 are noted under Contract Prices. The lowest bids received Oct. 18 for two sewers were those of E. J. Clarke, at $41,634 and $38,687. It is reported that all the work will be readvertised and bids received for both vitrified and cement pipe. The specifications heretofore have called for cement pipe.

SARATOGA SPRINGS, N. Y.—Bids are asked until Nov. 7 for constructing a pipe sewer in Division St. J. T. Dillon, Clk.

SEA CLIFF, N. Y.—The improvement association is discussing the sewerage question.

WOODBURY, N. J.—The construction of a system is again being discussed by the council. Plans for a system estimate the cost at about $38,000.

DU BOIS, PA.—The council has voted to issue $7,800 in bonds for constructing 11,950 ft. of 24 to 12-in. pipe sewers. C. F. L. McQuistion, Butler, Pa., who made the surveys, has been engaged to superintend the construction.

HARRISBURG, PA.—The Susquehanna Sewerage & Drainage Co. has been incorporated with a capital stock of $10,000. It is proposed to construct sewers in the section west of the city limits. Directors, L. R. Peffenberger, J. R. Blackwell and others.

SOUTH BETHLEHEM, PA.—The council has voted that the court be asked to authorize an issue of $100,000 in bonds for a system.

PORTSMOUTH, VA.—Press reports state that D. Lee Wardrope & Co., Macon, Ga., have thrown up the contract for constructing a system and that the work will be readvertised. The bids ranged from $46,151 to $151,529 and were published July 19 under Contract Prices. Engr., W. T. Brooke, Cy. Engr., Norfolk.

CHARLESTON, S. C.—W. W. Simons, Clk. of Council, informs us that the contract for furnishing the materials for the system has been awarded to Bailey-Lebby Co., of Charleston. It is probable that the construction will be by day labor.

SANDUSKY, O.—Bids are asked until Nov. 3 for constructing sewers, according to reports. A. W. Miller, Cy. Clk.

ELWOOD, IND.—The city engineer has been directed to prepare estimates for a 72 or 108-in. brick sewer to drain Duck Creek, estimated to cost between $80,000 and $100,000.

HUNTINGTON, IND.—Bids are asked until Nov. 12 for constructing a 15-in. pipe sewer. J. B. Vernon, Cy. Engr.

DETROIT, MICH.—The council has voted to submit to the vote of the people on Nov. 6 a proposition to issue $250,000 in sewer bonds.

KALAMAZOO, MICH.—The construction of a 24 to 12-in. pipe sewer, estimated to cost $4,500, is being discussed by the council.

ELGIN, ILL.—A commission, consisting of D. F. Barclay, W. H. Hintz and R. P. Jackman, has been appointed to secure plans and estimates for a system, but we are informed that no other action has yet been taken.

PEORIA, ILL.—The city engineer is preparing plans for 40 miles of pipe and brick sewers for the west bluff district, to be built next year, estimated to cost $250,000 to $300,000.

OCONTO, WIS.—E. L. Shaw, Jr., Cy. Engr., Marinette, who is engineer in charge of the work, informs us that the following bids were received Oct. 17 for constructing sewers as recently advertised in Engineering News:

Hinkley & Powers, Bayfield, Wis.	$20,896
Foley & Connelly, Menominee, Mich.	18,861
W. M. Campbell, Menominee, Mich.	26,053
McCann & McLellan, Watertown, Wis.	23,531
William Turner, Milwaukee (awarded contract)	18,811
James Markey, Milwaukee, Wis.	21,015
William Forestal, Milwaukee, Wis.	18,121
James H. Fife, Oshkosh, Wis.	20,466
N. F. Reichert & Co., Racine, Wis.	18,824
John Sanderson, Marinette, Wis.	20,219
J. D. Moran Mfg. & Construction Co., St. Paul	20,297
Kirkland & Starkey, St. Paul, Minn.	18,910
E. G. Mullen, Milwaukee, Wis.	19,088

OCONOMOWOC, WIS.—The citizens are to petition the council for a system.

ST. PAUL, MINN.—Bids are asked until Oct. 29 for constructing a sewer in Robie St. W. J. Mueller, Clk. Bd. Pub. Wks.

ST. LOUIS, MO.—The board of public improvements has decided to extend the Pine St. sewer at an estimated cost of about $30,000.

BUTTE CITY, MONT.—The following bids were received Oct. 11 for constructing sewers:

	Dakota St.	Granite St.	Missoula St.
John McCrimmon	$3,025	$1,300	$5,780
Winters, Parsons & Bloomer.	2,945	1,272	5,645
John O'Rourke	*2,275	*971	3,830
C. H. Bowman	2,625	1,040	4,624
James McGreevey & Co.	5,159	....	....
F. L. Reber	2,797	1,419	5,642
Butte Workingmen's Co-Operative Society	2,290	981	3,845
William McGrath & Co.	2,676	987	*3,792
J. W. Marshall	3,100	1,100	4,500

* Awarded contract.

LITTLE ROCK, ARK.—Bids are asked until Oct. 30 for constructing a sewerage system at the new military fort to be built near this city. Capt. Robt. R. Stevens, A. Q. M., U. S. A.

SAN ANTONIO, TEX.—The bids for the purchase of $500,000 of 5% sewer bonds have been rejected, owing to technicalities.

BERKELEY, CAL.—Contracts have been awarded to J. M. Creed, Michael Heaffy and Michael Corbett for constructing sewers.

LOS ANGELES, CAL.—The contract for furnishing 15 miles of 24 to 8-in. sewer pipe has been awarded to Denny Clay Co., Seattle, Wash., according to press reports, the other bidders being California Trust Association, Los Angeles Sewer Pipe Association, Oregon Pottery Co., Portland; besides bids from St. Louis, Kansas City, and Akron, O.

SACRAMENTO, CAL.—O. G. Flint, Cy. Clk., writes us that the board of trustees has adopted plans prepared by F. T. Newberry, San Francisco, but that no other action will be taken until the coming rainy season is over.

WATERLOO, ONT.—It is reported that bids have been asked for preparing the filter beds on the sewage farm.

STREETS

BANGOR, ME.—Bids are asked until Nov. 10 for furnishing 100,000 granite paving blocks for 1895. G. W. Stewart, St. Comr.

BOSTON, MASS.—Bids are asked until Oct. 27 for building a telford macadam road, the work to include 1,000 sq. yds. of telford and the same of macadam, 1,215 ft. of curbstones, 1,030 sq. yds. of brick sidewalks. H. H. Carter, Supt. of Sts.

NEW YORK, N. Y.—Bids are asked by the department of parks until Oct. 29 for 12,334 sq. yds. of paving with rock asphalt on concrete, 8,600 sq. yds. of granite block paving, 1,437 cu. yds. of concrete in place, 5,362 lin ft. of 5-in. curbstone.——The lowest bid received for grading, etc., Webster Ave., from Kingsbridge road to Southern Boulevard, was that of Kelly & Rogers, at $27,915, and the highest was Dunn & Armstrong, at $39,510.

ATLANTA, GA.—Bids are asked until Nov. 1 for furnishing and laying 110,000 sq. yds. of material for walks in the Exposition grounds; separate bids for each. Pres., C. A. Collier; Grant Wilkins, Chn. Bldgs. and Grounds Com.

AVONDALE, O.—Bids are asked until Nov. 9 for improving a portion of Greenwood Ave. W. E. Wynne, Corporation Clk.

CINCINNATI, O.—Bids are asked by the board of administration until Nov. 8 for paving one street with brick and one with granite.

NORWALK, O.—Bids are asked until Oct. 29 for grading and paving 248 lin. ft. on South Hester St. with brick. F. W. Christian, Cy. Clk.

SPRINGFIELD, O.—The city engineer estimates the cost of the proposed paving in West High St. with brick on 6 ins. of concrete at $6,252.

GRAND RAPIDS, MICH.—The contract for paving Ionia St. has been awarded to the Warren-Scharf Asphalt Paving Co. at $6,253.

MUSCATINE, IA.—Bids are asked until Oct. 27 for paving two streets with brick. D. T. Eaton, Recdr.

LEAVENWORTH, KAN.—The council has awarded the contract for paving Delaware St. with about 500,000 Atchison brick to R. K. Smith.

SEATTLE, WASH.—The following bids have been received by the board of public works for grading East St.: Taylor Bros., $3,198; J. S. Holt, $3,096; D. V. McDonald, $3,295; J. A. Bailey, $2,525; E. T. Smart, $3,016, and M. O'Day, $2,388.

ELECTRIC LIGHT AND POWER.

BUFFALO, N. Y.—The Niagara Falls Power Co. has petitioned the aldermen for a franchise to put up wires for the distribution of electric power.

SHERBURNE, N. Y.—The question of organizing a company to put in an electric light plant is reported as being discussed.

FREDERICK, MD.—The aldermen have asked for bids for a new dynamo for the electric light station.

MOUNTAIN LAKE PARK, MD.—Potter & Folwell, Pittsburg, have been engaged to prepare plans for an electric light plant.

DAYTON, O.—Bids are asked until Nov. 22 for erecting an electric light plant at the Dayton state hospital; Engr., B. F. Thomas; F. J. McCormack, Pres. Bd. of Trustees.

MARIETTA, O.—A. L. Gracey, John Kaiser and Thomas Ewart have petitioned the council for a franchise for an electric light plant.

SPRINGFIELD, ILL.—Bids are asked until Oct. 29 for constructing an electric light plant (postponement from Oct. 22.) E. A. Wilson, Secy., Citizens' Electric Co.

PORT HURON, MICH.—The council has decided to present to the voters at the coming election a proposition to bond the city for $40,000 for an electric light plant.

CHICAGO, ILL.—The Norwood Construction & Electric Co. has petitioned the aldermen for a franchise.

ALAMEDA, CAL.—The trustees have voted to advertise for bids for a new steam boiler 16 ft. in length for the electric light plant; also to abolish the tower system and to remove the towers.

COBDEN, ONT.—The dam across Gould Creek gave way Oct. 18 and the electric power house of Alexander McLaren was swept away; loss, $9,000. The dam was 250 ft. long and 35 ft. high.

NEW COMPANIES.—Marks-Ayer Electric Co., Plainfield, N. J.; $350,000; L. B. Marks, New York; J. J. Ayer, H. G. Runkle, Plainfield.——Eclipse Electrical Co., St. Louis, Mo.; $9,000; Isidor Fajan, E. C. H. Foelkers.——Excelsior Springs Gas, Light & Fuel Co., Excelsior Springs, Mo.; $20,000; R. C. Massie, E. L. Dimmit.——Seaforth Electric Light, Heat & Power Co., Seaforth, Ont.; $25,000; James Scott, F. Holmsted.——Capital Electric Co., Springfield, Ill.; $60,000; P. W. Harts, F. D. Buck, E. A. Wilson.——Germanic City Light Co., Chicago, Ill.; $50,000: P. M. Smith, C. M. McKeehan.——East Liverpool Telephone Electric Co., East Liverpool, O.; $10,000.——Commonwealth Construction Co., Camden, N. J.; $100,000; L. B. Henry, Eddington, Pa.; R. H. Crozer, Upland, Pa.; W. W. Hartel, Philadelphia; C. W. Weygand, Camden.——Citizens' Co-Operative Gas Co., Chicago, Ill.; $15,000,000; A. H. Dunham, J. P. Claddo, H. A. Forsyth.——Sinaloa Electric Light & Power Co., Des Moines, Ia.; $20,000; Pres., Jesus Escovar; Vice-Pres., Joachim Escovar; Secy., Treas. and Gen. Man., Carlos Escovar.——Northport Electric Light Co., Northport, N. Y.; $25,000; Pres., Edward Thompson; Vice-Pres., J. W. Fowler; Treas., W. H. Sammis; Secy., Edward Pidgeon; Gen. Man., J. W. Olmstead.——Mutual Gas & Electric Co., Brooklyn, N. Y.; $100,000; A. W. Wanmaker, Jersey City, N. J.; Thomas Patterson, Brooklyn; C. H. Selig, New York.

MISCELLANEOUS CONTRACTS AND SUPPLIES.

TELEPHONE FRANCHISE.—Clyde, N. Y.—The Wayne Telephone Co., of Clyde, has been granted a franchise by the village trustees.

DREDGING.—San Francisco, Cal.—Bids are asked until Nov. 12 for dredging in Petaluma Creek, Cal. Maj. W. H. Heuer, U. S. Engr. Office.

STEEL DECK PLATES.—Washington, D. C.—Bids are asked until Oct. 29 for 10 steel deck plates. Brig.-Gen. D. W. Flagler, Ch. of Ordnance, U. S. A.

PIER WORK.—Duluth, Minn.—Bids are asked until Nov. 10 for repairs of piers at Ontonagon, Mich., and Duluth, Minn. Maj. Clinton B. Sears, U. S. Engr. Office.

NAVAL SUPPLIES.—Washington, D. C.—Bids are asked until Nov. 10 for supplies for the Mare Island navy yard, Cal. Edwin Stewart, Paymaster Gen., U. S. N.

SHEAR LEGS.—Washington, D. C.—Bids are asked until Nov. 5 for 100-ton shear legs for the League Island navy yard. E. O. Matthews, Ch. of Bureau of Yards and Docks.

LEVEE WORK.—Delta, La.—Bids are asked until Oct. 31 for 100,000 cu. yds. of work on the Holly Brook levee, East Carroll parish, La. W. H. Shields, Secy. Comrs. Fifth Levee Dist.

DECKED BARGES.—New Orleans, La.—Bids are asked until Nov. 15 for constructing 10 decked barges for work of improvement, near Natchez, Miss. Capt. John Millis, U. S. Engr. Office.

GARBAGE CREMATORY.—Camden, N. J.—A committee has been appointed to visit the crematories at Pittsburg and McKeesport, Pa., and other places before investing the $10,000 appropriated for a garbage crematory in this city.

STONE.—Philadelphia, Pa.—Bids are asked until Nov. 19 for depositing stone in the gap at the Delaware Breakwater, Del., as stated in our advertising columns. Maj. C. W. Raymond, U. S. Engr. Office.

TUNNEL.—Brooklyn, N. Y.—A resolution has been introduced in the board of aldermen authorizing the

Brooklyn, New York & Jersey City Terminal Ry. Co. to construct a tunnel from near the Long Island Ry. station, Flatbush and Atlantic Aves., to the East River.

SCHOOL BUILDING.—Buffalo, N. Y.—M. Beebe & Son, Architects, have been instructed by the board of public works to supervise the construction of a new $40,000 school building to be built in the Elmwood Ave. district. Bids for the iron and other material will be asked for within a few days. R. G. Parsons, Secy. Bd. Pub. Wks., will furnish information.

FORT.—Little Rock, Ark.—Bids are asked until Oct. 30 for the following work at the new military fort to be built near this city: 3 double sets officers' quarters, 1 double barrack, 1 double outbuilding, 2 double sets N.-C. S. quarters, 2 mess buildings, 1 hospital, 1 guardhouse, 1 quartermaster and subsistence storehouse, 1 bakehouse, 1 quartermaster's stable, plumbing, sewerage and water supply, heating and gas piping of buildings, roads, exterior sewerage and water supply and grading, also for wardrobe lockers; buildings to be of brick, foundations of stone. Capt. Robt. R. Stevens, A. Q. M., U. S. A.

SEA WALL.—Philadelphia, Pa.—The following bids were received by E. O. Matthews, Ch. of Bureau of Yards and Docks, Washington, Oct. 20, for the construction of a protection wall at the League Island navy yard:

T. Benton Brown, Philadelphia, Pa.	$15,500
Benj. F. Sweeten & Son, Camden, N. J.	18,446
Jas. S. Allen, Philadelphia, Pa.	12,943
Jas. Duffy & Chas. Palmer, Lancaster, Pa.	20,983
Burt P. Evans & C. R. Kelly, Philadelphia, Pa.	19,890
Wm. A. Mundy, Philadelphia, Pa.	13,380
Frank C. Arthur, Philadelphia, Pa.	18,782

CONDENSED LIST OF CONTRACTS PENDING WITH DATE OF OPENING BIDS.

Bids to be opened.	Work.	Place.	See Eng. News.
Oct. 25.	Granite,	St. Augustine, Fla.	Sept. 27
	Advertised, Eng. News, Sept. 27 to Oct. 18.		
Oct. 25.	Jetty work,	New Orleans, La.	Oct. 4
Oct. 25.	Repaving,	Lansingburg, N. Y.	Oct. 11
Oct. 25.	Iron hoist bridge,	Dayton O.	Oct. 11
Oct. 25.	Water-works system,	Cameron, Tex.	Oct. 11
Oct. 25.	Water-works,	Cambridge City, Ind.	Oct. 11
	Advertised, Eng. News, Oct. 11 and 18.		
Oct. 25.	Sewers,	New York, N. Y.	Oct. 18
Oct. 25.	Electric lighting,	Oswego, N. Y.	Oct. 18
Oct. 25.	Sea wall, etc.,	Philadelphia, Pa.	Oct. 18
	Advertised, Eng. News, Oct. 18.		
Oct. 25.	Brick paving,	Cincinnati, O.	Oct. 18
Oct. 26.	Stone, cedar or brick paving,	Toledo.	Oct. 11
Oct. 26.	Grading (2½ miles),	Kansas City, Mo.	Oct. 11
Oct. 26.	Macadamizing (1½ miles),	Kansas City.	Oct. 11
Oct. 26.	Asphalt paving,	Brooklyn, N. Y.	Oct. 18
Oct. 26.	Pipe sewers,	Buffalo, N. Y.	Oct. 18
Oct. 26.	Pipe sewers, (20,000 ft.),	Ripon, Wis.	Oct. 18
Oct. 26.	Brick sewers (1,100 ft.),	Ripon, Wis.	Oct 18
Oct. 26.	Paving, etc.,	Philadelphia, Pa.	Oct. 18
Oct. 27.	Drainage,	Mount Vernon, N. Y.	Oct. 4
	Advertised, Eng. News, Oct. 4 and 11.		
Oct. 27.	Grading,	Kansas City, Mo.	Oct. 11
Oct. 27.	Electric lighting,	Grand Rapids, Mich.	Oct. 18
Oct. 27.	Telford macadam road,	Boston, Mass.	Oct. 25
Oct. 27.	Pmp'g station ext'n, etc.,	Boston, Mass.	Oct. 25
Oct. 27.	Brick paving,	Muscatine, Ia.	Oct. 25
Oct. 29.	Dredging and jetty work,	New Orleans.	Oct. 4
Oct. 29.	Electric lighting,	Fremont, O.	Oct. 18
Oct. 29.	Bridge bonds ($20,000),	Warren, O.	Oct. 18
Oct. 29.	Granite block paving,	New York.	Oct. 25
Oct. 29.	Asphalt paving, etc.,	New York.	Oct. 25
Oct. 29.	Steel deck plates,	Washington, D. C.	Oct. 25
Oct. 29.	Brick paving,	Norwalk, O.	Oct. 25
Oct. 29.	Electric light plant,	Springfield, Ill.	Oct. 25
Oct. 29.	Sewer, St. Paul,	Minn.	Oct. 25
Oct. 29.	Water-works system,	Wells, Minn.	Oct. 25
Oct. 30.	Dike work,	New York, N. Y.	Oct. 11
Oct. 30.	Rock,	New Orleans, La.	Oct. 11
Oct. 30.	Courthouse,	Waxahachie, Tex.	Oct. 11
Oct. 30.	Naval supplies,	Washington, D. C.	Oct. 18
Oct. 30.	Water-works system,	Sioux City, Ia.	Oct. 18
Oct. 30.	Water supply,	Little Rock, Ark.	Oct. 18
Oct. 30.	Fort,	Little Rock, Ark.	Oct. 25
Oct. 30.	Sewers,	Little Rock, Ark.	Oct. 25
Oct. 30.	Water-works system,	Little Rock, Ark.	Oct. 25
Oct. 31.	Drawbridges,	Chicago, Ill.	Sept. 6
	Advertised, Eng. News, Sept. 6 and 20.		
Oct. 31.	Bridge masonry,	Chicago, Ill.	Sept. 6
	Advertised, Eng. News, Sept. 6 and 20.		
Oct. 31.	Public building at	Rome, Ga.	Oct. 11
	Advertised, Eng. News, Oct. 11 and 18.		
Oct. 31.	Outlet sewer ext'n,	Cleveland, O.	Oct. 11
Oct. 31.	Water-works system,	Gibson City, Ill.	Oct. 18
	Advertised, Eng. News, Oct. 4 and 11.		
Oct. 31.	Water-works system,	Roseville, Ill.	Oct. 18
	Advertised, Eng. News, Oct. 25.		
Oct. 31.	Levee work,	Delta, La.	Oct. 25
Nov. 1.	Dredging, piers, etc.,	Milwaukee, Wis.	Oct. 4
	Advertised, Eng. News, Oct. 4 to 25.		
Nov. 1.	Paving bonds ($4,444),	St. Bernard, O.	Oct. 11
Nov. 1.	Electric light plant,	Lynchburg, Va.	Oct. 18
Nov. 1.	Walks (110,000 sq. yds.),	Atlanta, Ga.	Oct. 25
Nov. 1.	Water bonds,	Cambridge City, Ind.	Oct. 25
Nov. 1.	Water-wks system,	Long Prairie, Minn.	Oct. 25
Nov. 1.	Plans for w-wks., etc.,	Sudbury, Ont.	Oct. 25
Nov. 2.	Dredging,	Philadelphia, Pa.	Oct. 4
	Advertised, Eng. News, Oct. 4 to 25.		
Nov. 2.	Brick sidewalks,	Richmond, Ind.	Oct. 18
Nov. 3.	Sewers,	Sandusky, O.	Oct. 25
Nov. 5.	Dike work,	Philadelphia, Pa.	Oct. 11
	Advertised, Eng. News, Oct. 11 to Nov. 1.		
Nov. 5.	Asphalt paving,	Cincinnati, O.	Oct. 11
Nov. 5.	Brick paving,	Cincinnati, O.	Oct. 11
Nov. 5.	Dredging,	Philadelphia, Pa.	Oct. 18
Nov. 5.	Furnishing dredges,	New Orleans, La.	Oct. 18
Nov. 5.	Bridges,	Meridian, Miss.	Oct. 18
Nov. 5.	Asphalt paving,	Cincinnati, O.	Oct. 18
Nov. 5.	100-ton shear legs,	Phila. navy yard.	Oct. 25
Nov. 6.	Filter Plant,	Beaver Falls, Pa.	Oct. 11
	Advertised, Eng. News, Sept. 13 to Oct. 11.		
Nov. 6.	Breakwater and piers,	Milwaukee, Wis.	Oct. 4
	Advertised, Eng. News, Oct. 4 to 25.		
Nov. 6.	Electric lighting,	Terre Haute, Ind.	Oct. 18
Nov. 7.	Public building work at	York, Pa.	Oct. 11
	Advertised, Eng. News, Oct. 11 and 18.		
Nov. 7.	Water bonds,	Arlington Heights, O.	Oct. 11
Nov. 7.	Pipe sewers,	Ironton, O.	Oct. 18
Nov. 7.	Dredging,	Wilmington, N. C.	Oct. 11
	Advertised, Eng. News, Oct. 11 to Nov. 1.		
Nov. 7.	Pipe sewer,	Saratoga Springs, N. Y.	Oct. 25
Nov. 7.	Water bonds,	Long Prairie, Minn.	Oct. 25
Nov. 7.	Water supply, etc.,	Fort Reno, Okla.	Oct. 25
Nov. 8.	Outlet sewer,	Cranford, N. J.	Oct. 18
	Advertised, Eng. News, Oct. 18 to Nov. 1.		
Nov. 8.	Granite paving,	Cincinnati, O.	Oct. 25
Nov. 8.	Brick paving,	Cincinnati, O.	Oct. 25
Nov. 8.	Water-works system,	Talmage, Neb.	Oct. 25
Nov. 9.	Dredging,	Wilmington, Del.	Oct. 11
	Advertised, Eng. News, Oct. 11 to Nov. 1.		
Nov. 9.	Furnishing dredge,	New Orleans, La.	Oct. 18
Nov. 9.	Grading, etc.,	Hamilton, O.	Oct. 18
Nov. 9.	Iron bridge,	New Orleans, La.	Oct. 25
Nov. 9.	Street improvements,	Avondale, O.	Oct. 25
Nov. 9.	Stand-pipe,	St. Charles, Mo.	Oct. 25
	Advertised, Eng. News, Oct. 25 and Nov. 1.		
Nov. 10.	Granite blocks (100,000),	Bangor, Me.	Oct. 25
Nov. 10.	Naval supplies,	Washington, D. C.	Oct. 25
Nov. 10.	Water-works system,	Rossville, Ill.	Oct. 25
Nov. 10.	Pier work,	Duluth, Minn.	Oct. 25
Nov. 11.	Pumping engines,	Chicago, Ill.	Oct. 18
	Advertised, Eng. News, Sept. 13 to 27.		
Nov. 12.	Pipe sewer,	Huntington, Ind.	Oct. 25
Nov. 12.	Artesian wells,	Wichita, Kan.	Oct. 25
Nov. 12.	Dredging,	San Francisco, Cal.	Oct. 25
Nov. 13.	Heatg & vent'g ap., etc.,	Sioux Falls, S. D.	Oct. 18
	Advertised, Eng. News, Oct. 18 and 25.		
Nov. 14.	Dredging,	Charleston, S. C.	Oct. 18
	Advertised, Eng. News, Oct. 18 to Nov. 8.		
Nov. 14.	Revetting banks,	Charleston, S. C.	Oct. 18
	Advertised, Eng. News, Oct. 18 to Nov. 8.		
Nov. 15.	Decked barges,	New Orleans, La.	Oct. 25
Nov. 15.	Water-works system,	Union City, O.	Oct. 25
Nov. 19.	Stone,	Philadelphia, Pa.	Oct. 25
	Advertised, Eng. News, Oct. 25 to Nov. 15.		
Nov. 22.	Electric light plant,	Dayton, O.	Oct. 25
Dec. 1.	Electric lighting,	Ann Arbor, Mich.	Oct. 11

CONTRACT PRICES.

ASPHALT PAVING.—Chicago, Ill.—The following bids were received Oct. 16 for paving Harrison St., from Paulina St. to Western Ave., with asphalt:

Bidder.	Curbing.	Paving.
Bermudez Asphalt Paving Co.	$0.65	$1.46
Western Paving Co.	.75	1.76
Trinidad Asphalt Co.	.75	1.46
Standard Paving Co.	...	1.73
James A. W. Pine	.75	1.59

HIRE OF DREDGING PLANT.—Buffalo, N. Y.—Maj. E. H. Ruffner, U. S. Engineer Office, has awarded the contract for the hire of a dredging plant, including submarine drill boat, for deepening the channel of the Niagara River, between Port Day and Tonawanda, to Hingston & Woods, Buffalo, at $80 a day. Carkin, Stickney & Crane, Saginaw, Mich., bid $130 per day; appropriation, $30,000.

RESERVOIR.—Beaver Falls, Pa.—The following bids were received Oct. 16 for constructing a reservoir for the new water-works; Engrs., James H. Harlow & Co., Pittsburg:

Bidder.	Mystic River, Conn.	New Haven Harbor, Conn.	Bridgeport Harbor, Conn.	Norwalk Harbor, Conn.	Remarks.
Emory R. Seward, Albany, N. Y.	...	...	...	*$0.115	*Lowest bid; Norwalk Harbor; withheld pending investigation.
C. & H. E. Du Bois, 119 South St., N. Y.	$0.16	$0.15	$0.13	.18	
J. H. Fenner, 389 Comm'pawAve., Jersey City	.14	*.12	.14	.30	*Lowest bid; New Haven Harbor; rejected as too high.
A. J. Beardsley, Bridgeport, Conn.	.15	.155	*.115	.143	*Lowest bid; Bridgeport; recommended
Alonzo E. Smith, Islip, N. Y.	.18	.16			
Elijah Brainard, 24 State St., N. Y.	.17	.175	.155	.18	
Hartford Dredging Co., Hartford, Conn.	*.137	.16	.16	.16	*Lowest bid; Mystic River, Conn.; recommended.
Newburg Dredging Co., Newburg, N. Y.	.28	...	...	.145	

Bids Received at New York, Oct. 16, for Dredging

The bids for dredging East Chester Creek, N. Y., were rejected, the lowest being considered excessive. These bids were as follows: Alonzo E. Smith, Islip, N. Y., 40 cts per cu. yd. for removing shoals and 24.5 cts. for deepening channel, prism measure (lowest bid); Jas. McSpirit, 330 Third St., Jersey City, N. J., 35 cts. and 24½ cts., scow measure; Robt. E. Brown, Ronkonkoma, N. Y., 30 cts. and 31 cts., prism measure.

Milwaukee, Wis.—The following bids were received at the U. S. Engineer Office Oct. 3 for 30,000 cu. yds. of dredging in Milwaukee Harbor, the price being per cubic yard:

Wisconsin Dredge & Dock Co., Manitowoc, Wis.	$.118
C. C. Starke, Milwaukee, Wis.	.19
S. O. Dixon, Racine, Wis.	.24

SEWERS.—Argentine, Kan.—Geo. M. Walker, Jr., Cy. Engr., writes us that the contract for a 15-in. pipe sewer has been awarded to Wallace Ford, the bids being as follows:

	15-in. pipe sewer.	Manholes.	Catch-basins.	Furnishing 12-in. sewer pipe.	Oak lumber in place.
R. B. Brown and T. J. Payne	$1.32	$43.50	$47.50	$0.18	$23.50
Wallace Ford	.84	22.00	42.00	....	10.00
A. W. Boeke	1.23	35.00	40.00	.22	20.00

Brooklyn, N. Y.—Bids were opened Oct. 12 for three contracts for pipe sewers, the lowest bids for cement pipe aggregating about $83,000, and for vitrified pipe $1,367 less, but as the specifications called for cement pipe, all other bids were rejected as informal. It is probable that the work will be readvertised and bids received also for vitrified pipe. The lowest bid for the sewer in subdivision No. 2 was that of Stratford & Hawkes, at $41,799 for vitrified pipe, the lowest for cement pipe being at $42,806. The bids for this work were as follows:

	Harris & Maguire.	Cranford & Co.	Clark & Harrison.	D. J. Creem.	Edward Gorman.
24-in.	$2.40	$2.40	$2.42	$2.37	$2.13
18-in.	1.80	1.75	1.72	1.67	1.43
15-in.	1.59	1.55	1.35	1.37	1.23
12-in.	1.27	1.10	1.00	.97	.91
Manholes	32.00	30.00	31.00	30.00	27.00
Basins	100.00	95.00	96.00	97.00	95.00

Bids for Constructing Reservoir, Beaver Falls, Pa.

Quantities.	Allen & Co., Wampum, Pa.	Funkhauser & Ramsey, Beaver Falls.	J. W. Kelly, New Brighton, Pa.	G. M. Spaulding, Beaver Falls, Pa.	J. Giandini, Allegheny, Pa.	A. Tubman, Gallipolis, O.	Chandler Bros. & Co., Beaver Falls.
Earth excavation, 18,000 cu. yds.	$0.27	.33	.40	.35	.50	.29	.35
Rock excavation, 500 cu. yds.	.55	.80	.95	.45	.70	.60	1.00
Puddle, 100 cu. yds.	.50	2.00	1.00	1.50	1.25	.60	2.00
Concrete, 20 cu. yds.	4.25	6.00	4.00	3.50	5.00	3.75	5.50
Rubble masonry in cement, 20 cu. yds.	5.00	5.75	3.10	3.50	5.00	4.00	5.25
Dry masonry, 120 cu. yds.	4.40	4.00	2.40	2.50	4.00	3.50	3.75
Brick masonry, 10 cu. yds.	7.00	8.25	9.90	5.00	8.00	7.75	8.00
Cutstone masonry, rock face, 2 cu. yds.	9.00	6.90	7.25	4.75	10.00	9.00	7.00
" " " " " 2 cu. yds.	10.00	9.20	10.75	5.75	10.00	10.00	8.50
Brick lining on side, 4,300 sq. yds.	.63	.80	.65	.45	.97	.72	.55
" " " edge, 1,600 sq. yds.	.83	1.18	1.00	.70	1.50	1.10	.80
" " " end, 350 sq. yds.	1.30	2.14	2.10	1.28	2.55	2.02	1.70
Dressed coping, 6 × 16 ins., 860 ft.	.70	.75	.75	.50	1.00	.85	.70
Laying 24-in. pipe, 200 ft.	.90	1.40	1.00	.40	1.00	.75	1.50
" 16-in. pipe, 200 ft.	.75	1.25	.65	.35	.80	.45	1.25
" 6-in. pipe, 200 ft.	.25	.20	.45	.25	.30	.31	.20
Fencing, 2,300 ft.	.20	.60	.80	.39	1.00	.27	.70
Total.		$11,940	$16,042	$16,375	$12,216	$21,318	$14,265	$14,718

DREDGING.—Portland, Me.—The following bids were received by Lieut.-Col. P. C. Hains, U. S. Engineer Office, Oct. 15, for 120,000 cu. yds. of dredging in Back Cove, Portland Harbor; Chas. W. Anthony, Fall River, Mass., per cu. yd., 16.8 cts.; Moore & Wright, Portland, Me., per cu. yd., 16.5 cts.

Washington, D. C. — The only bid received by Maj. Chas. E. L. B. Davis, U. S. Engineer Office, Oct. 17, for dredging in Aquia Creek, was that of Thos. P. Morgan, Washington, D. C., at 15 cts. per cu. yd. For dredging in Occoquan Creek, Mr. Morgan bid 20 cts. for material deposited on sides of channel, or 40 cts. if removed in scows.

Portland, Ore.—Captain Symons, U. S. Engineer Office, has awarded the contract for dredging Olympia Harbor to the Bowers Dredging Co., at 16 cts. per cu. yd.; appropriation, $40,000. The citizens of Olympia will put in bulkheads and have the dredged material used to fill in Fourth St. bridge, the waterways being left through the embankment. Capt. Symons received but one bid for dredging in Swinomish Slough, that of the Bowers Dredging Co., at 16 cts. For pile dikes three bids were received, all at the same price.

Washington, D. C.—The following bids were received by Maj. Chas. E. L. B. Davis, U. S. Engineer Office, Oct. 4, for dredging in (1) Nomini and (2) Lower Machodoc creeks, Va., the price being per cubic yard:

	1.	2.
Chester T. Caler, 1 Campbell's Wharf, Norfolk, Va.	$.26	$.20½
T. P. Morgan, 1341 Q St., Washington, D. C.	.23	.23
Virginia Dredg. Co., Box 446, Richmond, Va.	.28	.23

Boston, Mass.—The following bids were received by Col. S. M. Mansfield, U. S. Engineer Office, Oct. 8, for dredging in Weymouth River, Mass.:

Augustus B. Martin, Boston, per cu. yd.	$0.36
Seth Perkins & J. E. White, Boston, per cu. yd.	.29
Eastern Dredging Co., Portland, Me., per cu. yd.	.37½

New York, N. Y.—The following bids were received by Lieut.-Col. Henry M. Robert, U. S. Engr. Office, Oct. 16, for dredging:

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BRICK PAVING.—Toronto, O.—M. B. Edwards, Jr., Cy. Clk., writes us that a contract for 1,200 sq. yds. of paving with fire brick has been awarded to A. J. Wil-

iamson, at 90 cts. per sq. yd.; Engr., M. E. Boyd, Wellesburg, W. Va.

Cincinnati, O.—The following bids were received by the county commissioners Oct. 13 for laying vitrified brick pavements in the battery drill hall on Freeman Ave.: M. F. Flynn, 95 cts. per sq. yd. for the best brick; Henry Dickmeyer, $1.10; Folz & Danenhauer, $1; Joseph G. Geiges, $1.25; Evan Evans, 94 cts.; M. C. Hayes, 99 cts.; James Agnes, $1.10; Henkel & Sullivan, $1.05.

Lansing, Mich.—The following bids have been received for paving Washington Ave. south from Kalamazoo St. to Grand River:

	Woodcock & Kneal.	Charles Sailer.	M. E. Fitzpatrick.	J. Conn.
Excavation, 3,250 cu. yds.	$0.095	$0.10	$0.10	$0.09
4-in. socket pipe, 3,410 ft.	.06	.055	.06	.06
Straight curbing., 3,506 ft.	.30	.30	.38	.29
Corners, 369 ft.....	.40	.40	.40	.40
Marginal curbing, 589 ft..	.35	.38	.39	.35
Brick paving, 9,750 sq. yds.	.92	.95	.87	[1].57
[1]Concrete, 9,750 sq. yds...	.47	.53	.55	[2]
Tar filling, 9,750 sq.yds..	.10	.08	.11	[2]
[2]Sand cushion,9,750 sq.yds	.015	.02	.03	[2]
Total	$16,593	$17,341	$17,169	$17,175

[1] 6 ins. deep. [2] 6 ins. concrete, tar or cement filling and sand cushion included in the $1.57 per sq. yd. [2] 2 ins. deep.

METAL MARKET PRICES.

LEAD.—New York: 3.1 to 3.12 cts. Chicago: 2.95 cts. St. Louis: 2.9 to 2.92 cts.

NAILS.—Pittsburg: $1 for wire, and 85 to 90 cts. for cut at mill, in carload lots.

BARBED WIRE.—Pittsburg: galvanized, $2 to $2.05; plain, $1.25 for carload lots at mill.

FOUNDRY AND PIG IRON.—New York: $10.50 to $13. Pittsburg: $10.75 to $11.75. Chicago: $9.50 to $11.50.

TRACK MATERIAL.—New York: angle bars, 1.25 to 1.4 cts.; spikes, 1.55 to 1.7 cts.; track bolts, 2 to 2.1 cts. with square, and 2.15 to 2.3 cts. with hexagon nuts. Chicago: angle bars, 1.25 to 1.35 cts.; spikes, 1.65 to 1.75 cts.; track bolts, 2.1 to 2.2 cts., with hexagon nuts.

RAILS.—New York: $24 at eastern mills and at tidewater; old rails, $10.50 to $11.50 for iron and $8 to $8.50 for steel; steel rails, fit for relaying, $16 to $19; light rails, $22 to $24; girder rails, $24. Pittsburg: $24 for standard sections. Chicago: $25 to $27; old rails, $11 for iron and $7.50 to $11 for steel.

STRUCTURAL MATERIAL.—New York: beams, 1.3 to 1.5 cts.; channels, 1.35 to 1.5 cts.; angles, 1.3 to 1.35 cts.; tees, 1.4 to 1.6 cts.; universal mill plates, 1.25 to 1.35 cts.; steel plates, 1.3 to 1.4 cts. for tank, 1.4 to 1.5 cts. for shell, 1.6 to 1.65 cts. for flange, 1.75 to 2 cts. for ordinary firebox, 2 to 2.25 cts. for locomotive firebox. Pittsburg: beams, 1.25 to 1.35 cts.; channels, 1.25 to 1.35 cts., angles, 1.15 to 1.2 cts.; tees, 1.35 cts.; universal mill plates, 1.15 to 1.2 cts.; steel plates, 1.15 to 1.25 cts. for tank, 1.25 to 1.35 cts. for shell, 1.3 to 1.4 cts. for flange, 2.5 to 3.75 for ordinary firebox, and 3.35 to 3.5 cts. for locomotive firebox. Chicago: beams, 1.5 cts.; channels, 1.5 cts.; angles, 1.4 to 1.45 cts.; tees, 1.65 cts.; universal plates, 1.4 to 1.45 cts.; steel plates, 1.4 to 1.5 cts. for tank, 1.65 to 2.1 cts. for flange, 1.65 to 5 cts. for firebox.

INDUSTRIAL NOTES.

THE LENOIR CAR CO., of Lenoir City, Tenn., has completed its works, which have a capacity of 15 cars per day.

THE WESTINGHOUSE ELECTRIC & MFG. CO. will concentrate all its work at Brinton, Pa., where it has established one of the largest manufacturing plants in the world.

THE NEW BRITAIN ART TERRA COTTA CO., of New Britain, Conn., had its factory at Berlin, Conn., destroyed by fire on Oct. 20, involving a loss of $20,000 on the plant and $50,000 on finished stock.

THE INDUSTRIAL WORKS, of Bay City, Mich., have received a contract for a locomotive crane for a government navy yard. The company has also filled an order recently for a steam shovel for handling iron ore in Sweden.

THE NEW YORK MASTIC WORKS, the American branch of the Compagnie Generale des Asphaltes de France, of Paris, state that advices have been received to the effect that the latter company has received the highest gold medal prize at the International Exhibitions at both Lyons and Antwerp, for superiority in quality of its Seyssel and Mons asphalts, and for excellence of work.

MR. G. P. WERN, formerly Chief Draftsman for the Lidgerwood Mfg. Co., has begun the manufacture of a new hoisting engine, with a patented improvement in its friction clutches. Mr. Wern's offices are in the Havemeyer Building and the engines are built by the Montauk Iron Works. One of Mr. Wern's engines was shipped this week to the Yonkers Coal Co., of Yonkers, N. Y., where it will be erected to operate a coal transfer built by the Coal Handling Machinery & Construction Co., of No. 1 Broadway, New York city.

THE YOUNG NUT LOCK CO., of New York, has added to its specialties a flexible adjustable bracket for electric railway work. The horizontal arm that supports the trolley wire is pivoted at its center, so that the trolley wire is suspended in an even and more flexible manner than that attained with the span wire system of construction, since the end of the supporting arm next to the pole acts as a counterweight, enabling the trolley wire to yield to the upward pressure of the trolley wheel, with no jar or shock. The Young nut lock and the Brownley injector are other specialties of this company.

THE GEO. F. BLAKE MFG. CO., of New York city, reports that the cruiser "Maine," which was given a trial last week, is supplied with a complete outfit of Blake pumps, including hydraulic pumps for working the guns, and special independent combined air and circulating pumps for the main engines. These pumps are each supplied with two vertical single-acting air cylinders, 30 ins. diameter, these being worked by means of a beam and links from 12-in. high-pressure and 24-in. low-pressure horizontal steam cylinders connected directly to a 31-in. circulating cylinder. In addition to these the outfit includes main and auxiliary feed-pumps of the vertical duplex type, fire, bilge and engine room auxiliary pumps, etc. The company's improved high-duty pumping engine has been selected for the Honolulu water-works, the engine selected being of the high-speed automatic cut-off type; the machinery is now in course of construction at the East Cambridge works of the company.

THE AMERICAN ELECTRIC SMELTING CO., recently organized at Wheeling, W. Va., under the patents of Jos. B. Hall, write us that they propose to erect a plant for the manufacture of aluminum by electrolysis, and wish to negotiate with parties having desirable manufacturing sites. They are also in the market for a steam plant with all appurtenances, amounting to about 1,500 HP., electrical dynamos, controllers, etc., supplies for melting furnaces, chemical laboratory and office, hydraulic presses, pumps and numerous other supplies. The officers of the company are: J. A. Campbell, President; T. H. B. Haase, Vice-President and Business Manager; Robt. C. Haase, Secretary; Chas. Menkemeller, Treasurer. Mr. Jos. B. Hall, the inventor of the process, is the manager of the operating department, and all correspondence should be addressed to him, Cor. 22d and Chapline Sts., Wheeling, W. Va. From such information as we can gather, we do not find that the company has yet raised the capital for its enterprise, or that the commercial practicability of its process has ever been tested.

NEW COMPANIES.—Ash Automatic Electric Switch Co., Newark, N. J.; $50,000, commencing with $1,000; Joseph Samuel, Joseph H. Ash and W. V. Ash.——Citizens' Gas & Electric Power Co., Lafayette, Ind.; $100,000; P. C. Somerville, A. O. Behm and L. Sparks.——Blockade Mountain Land Co., Jersey City, N. J.; $50,000, all paid in; R. H. Waggoner and John F. Reynolds, of Brooklyn, N. Y., and N. W. Gage, of New York city.——St. Louis & Illinois Construction Co., East St. Louis, Ill.; $20,000; William Berry, John Dean and W. H. Clancy.——New Orange Industrial Association, Newark, N. J.; $500,000, commencing with $1,000; G. W. Robinson, of East Orange, N. J.; C. M. Tompkins and Platt V. Bryan, of Elmira, N. Y.

MUNICIPAL BOND MARKET.

New York, Oct. 23, 1894.

The point has been several times made in these columns of late that the supply of first-class bonds was steadily running down, so that any sale just now of a first-class issue would result in obtaining very high prices. How well this is borne out by the facts is demonstrated by the sale to-day of some Boston bonds. The bonds offered consisted of $1,000,000 30-year public park 4's, and $300,000 20-year public park 4's. Harvey Fisk & Sons, who but lately entered the municipal bond market, and Blake Bros. jointly bought up the entire issue, paying 113.55 for the 30-year 4's, and 110.64 for the 20-year 4's. These are extremely high prices, in fact they are the highest prices ever received by the city of Boston for any of its bond issues. The eagerness of bond houses to pick up good new issues wherewith to replenish their much-depleted stocks, resulted in a large number of bids, all the big bond dealing firms making strenuous efforts to acquire the issue. That the bids were close is evidenced by the fact that the next highest bid, made by R. L. Day & Co., of Boston, was only ½ of 1 per cent. below the high offers recorded above.

The Boston bond sale is to-day the sole topic of conversation among the bond brokers, inasmuch as it offers such a splendid interpretation of the municipal bond market's situation. The plethora of money treated of in former reviews, continues as large as ever, and the banks and other moneyed institutions are continuing their practice of grabbing up good short-time municipal bonds, as even the low rates of interest they offer at current high quotations insure better returns than lending money on call at 1 per cent., and a risk at that, while municipal bonds are practically fully guaranteed as to both principal and interest.

A glance at the appended table of current quotations will show that the returns yielded by most bonds must now be very little. In a list furnished by N. W. Harris & Co., there are 22 lots that yield less than 4 per cent. on the investment at the prices asked. In the list of offerings by Farson, Leach & Co., there are 19 lots which yield less than 4 per cent. on the investment at the prices asked. These are indications as to how eagerly investment buyers are picking up first-class municipal bonds and how out of proportion to the demand is the supply. Brokers report that their stocks are at an extremely low ebb and they are carrying nothing but odds and ends. In the list of Farson, Leach & Co., referred to above, there is but one block of municipal bonds amounting to $75,000. The next largest block is one of $35,000, and there are just ten blocks of bonds amounting to $15,000 and over. There are 40 lots offered of $10,000 and under. What Farson, Leach & Co. have to contend with is the experience of all bond dealers.

Right here it is well to repeat the advice that the present is a most propitious time for municipalities, townships, counties and states to dispose of new bond issues for necessary public improvements. Money is a drug on the market, and it will eagerly welcome any opportunity of profitably employing itself. No second-rate bonds are wanted, as there is still too much distrust in the financial air to allow of the acquisition of any doubtful issues. In fact, it is just by reason of the unwillingness to engage in any enterprise involving the slightest risk that makes money so plentiful. But a first-rate, well-secured bond will be eagerly snatched up if properly advertised.

There are few sales by municipalities reported. Whann & Schlesinger, a new house, celebrated their advent into the municipal bond market by buying $45,000 Mt. Vernon school 4's and $24,000 Mt. Vernon assessment 5's. The bonds are offered respectively at 105⅝, netting 3.60 per cent., and 108, netting 3¼ per cent.

As furnishing to contractors, engineers and other interested parties some indication as to the credit of municipalities with which they have dealings, the following table of current offerings is appended:

MUNICIPAL BONDS.

	Price.
City of Rochester, N. Y., Water 7s	127
City of St. Louis, Mo., Refunding, 6s	121½
City of Milwaukee, Wis., 7s.....	118½
State of California, Dock 4s.....	110
City of Menominee, Mich., School 6s.....	113
City of Birmingham, Ala., Impvt. 6s.....	108
City of Lawrence, Mass., Funding 4s.....	108½
Asbury Park, N. J., Water 5s.....	108
City of Mt. Vernon, N. Y., Ass. 5s.....	108
" " " " School 4s.....	105⅜
New Utrecht, N. Y. (Brooklyn), Impvt. 5s.....	113⅜
State of Idaho, Wagon Road 5s.....	108½
City of Manchester, N. H., 4s.....	106½
City of Lawrence, Mass., 4s.....	108½
City of Omaha, Neb., 5s.....	111

RAILWAY STOCK MARKET.

New York, Oct. 23, 1894.

A hardly more gratifying state of affairs can be treated of this week than was outlined in these columns a week ago. What has served within the last few days to retard more than any one thing else the gradually growing symptoms of increasing confidence, is the phenomenally low figures at which our two great exportable staples—wheat and cotton—are now selling. With wheat at one time as low as 51 cents a bushel and cotton down to less than 5½ cents a pound, conditions are not such as to logically warrant hopes of big improvement in the commercial and financial worlds. Not only is there an interruption to progress in general, but railways will find in these low prices for wheat and cotton facts that hardly argue well for their future. The first effect of such continued low prices must be a revival of that demand for lower rates as marked as when wheat prices first began to decline some years ago. The agriculturalist West and South must retrench somewhere when he receives for his product less than the cost of growing and harvesting the crop, and his first move will be in the direction of lower railway tariffs. Secondly, the agriculturalist will restrict his planting when he finds it a loss to grow a crop, and this means a curtailing to a large degree of the railways' revenues. It is on such well-based calculations as to future happenings that the railway stock market has been depressed of recent days.

It is saying too much, however, when the situation is commented on as being altogether bearish. There are points in the situation that look to better things. One of these is to be found in the increasing railway earnings. It has already been pointed out in these columns that September gross earnings averaged but about 6¼ per cent. below receipts for the same month last year, without making any allowance for the feature that in September, 1893, the Immense World's Fair travel was at its height. This was, therefore, regarded as an extremely satisfactory showing. Since Oct. 1 the railways have, on a whole, done even better. Many companies are reporting all increased traffic for the first and second weeks of the current month, and this is accepted as a very good indication as to coming conditions. To quote examples, the Missouri, Kansas & Texas shows an increase for the first week of October of $44,700; Norfolk & Western, $26,900; Missouri Pacific, $51,187; Peoria, Decatur & Evansville, $15,900; International & Great Northern, $33,600; Louisville & Nashville, $67,510. There is a deal of encouragement in these symptoms as to returning business. From this time on, railway earnings will begin to compare with a period of last year, when the totals were not materially affected by the great travel to the World's Fair. That gains are already being reported is a good indication that in the future comparisons will make a showing very gratifying to railway managers.

Speculation itself continues as dull as ever witnessed in midsummer months; what activity is at all displayed emanates from bear quarters that always find it easy to depress prices in periods of listlessness, but transactions are utterly beyond any significance, except that attaching to the whims of professional traders.

RAILWAY STOCK MARKET.

Railway stocks.	Closing prices Oct. 24.
Alton & Terre Haute.....	82
Atchison, Topeka & Santa Fe.....	5¼
Baltimore & Ohio.....	69
Canada Southern	50⅜
Chesapeake & Ohio.....	18⅛
Chicago, Burlington & Quincy.....	73
Chicago & Northwestern.....	103¾
Chicago, Milwaukee & St. Paul.....	60⅝
Chicago, Rock Island & Pacific.....	60
Cleveland, Cincinnati, Chicago & St. Louis.....	38¼
Delaware, Lackawanna & Western.....	166
Delaware & Hudson.....	131
Hocking Valley.....	17¼
Illinois Central.....	91
Lake Shore & Michigan Southern.....	135
Louisville & Nashville.....	51½
Missouri Pacific.....	27⅜
Missouri, Kansas & Texas.....	13
Mobile & Ohio.....	18½
New Jersey Central.....	107½
New York Central.....	99⅝
New York & New England, 3d asst. pd.....	31⅜
New York, New Haven & Hartford.....	183
New York, Chicago & St. Louis, 1st pfd.....	65½
New York, Lake Erie & Western.....	13¾
New York, Ontario & Western.....	16
New York, Susquehanna & Western.....	15
Northern Pacific.....	4⅜
Northern Pacific, pfd.....	16
Philadelphia & Reading.....	18¾
Richmond Terminal.....	17½
St. Paul & Omaha.....	35
Southern Pacific.....	19½
Texas Pacific.....	9⅞
Union Pacific.....	11⅝
Wabash, pfd.....	14½
Wheeling & Lake Erie.....	11½

BOSTON RAILWAY STOCKS.

	Oct. 23.
Boston & Albany.....	204½
Boston & Maine.....	149
Fitchburg, pfd.....	76
Old Colony.....	178

PHILADELPHIA RAILWAY STOCKS.

	Oct. 23.
Lehigh Valley.....	57½
Pennsylvania Railroad.....	51½